VOLUME XXIII NUMBER SEVEN

The NATIONAL GEOGRAPHIC MAGAZINE

JULY, 1912

CONTENTS

Little-Known Parts of Panama — HENRY PITTIER
With 35 Illustrations and Map

The Fight Against Forest Fires — HENRY S. GRAVES
With 19 Illustrations

Surveying the 141st Meridian — THOMAS RIGGS, Jr.
With 46 Illustrations and Map

Where Our Bananas Come From — EDWIN R. FRASER
With 14 Illustrations

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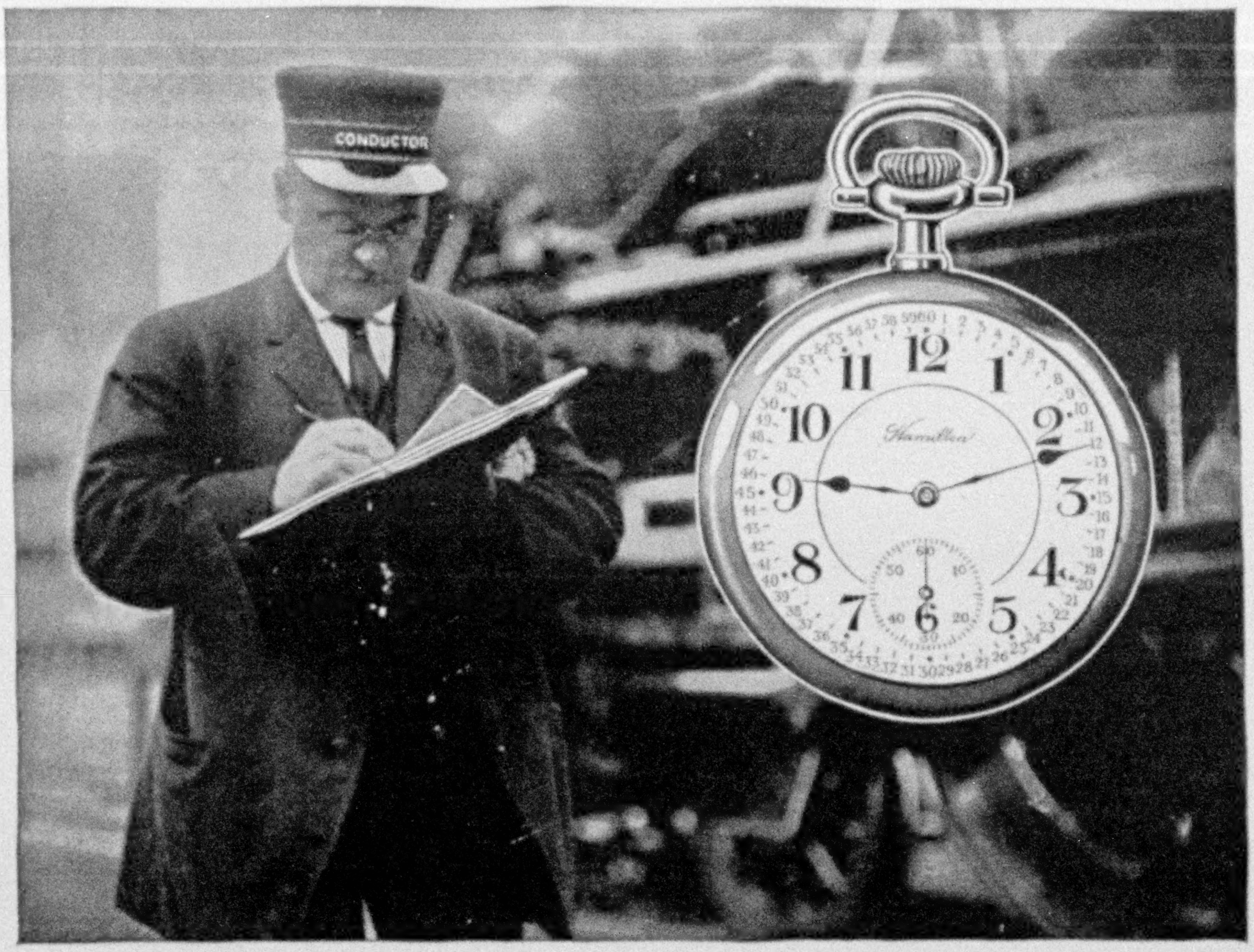

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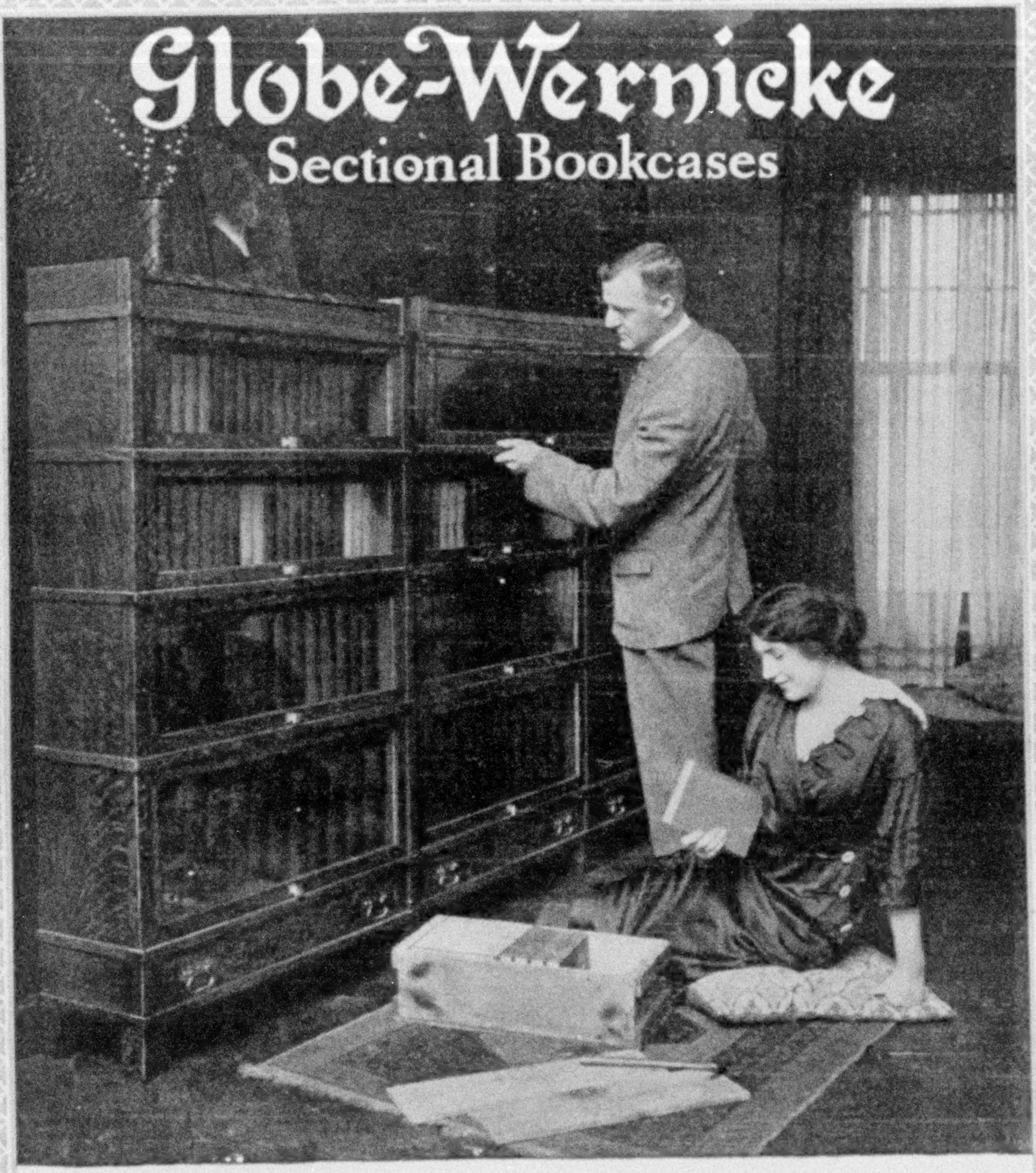

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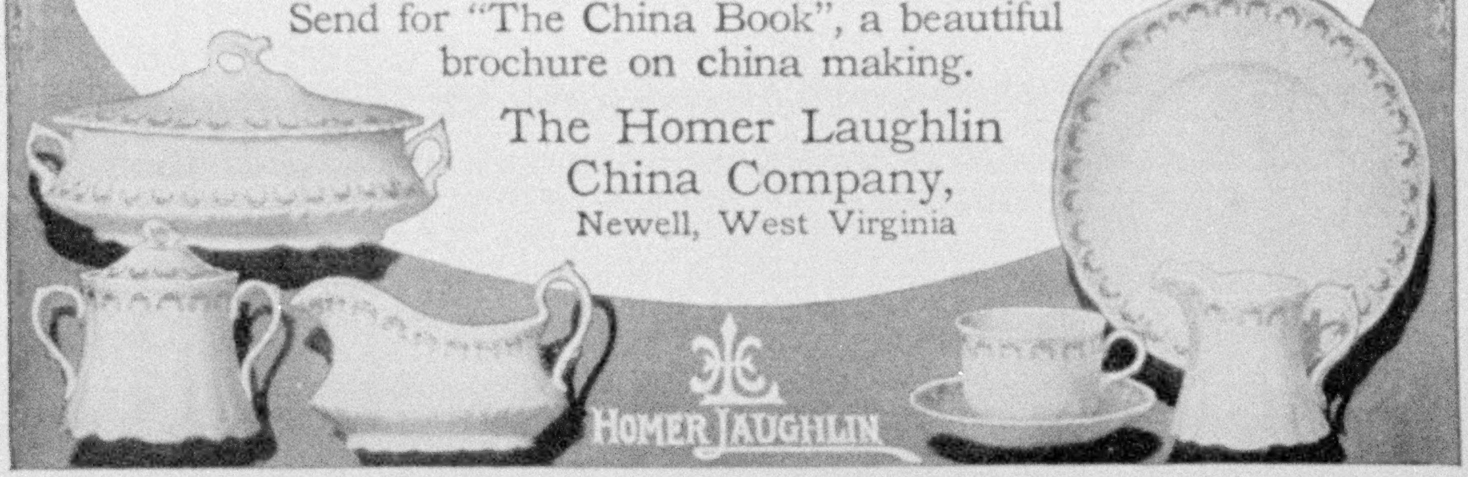

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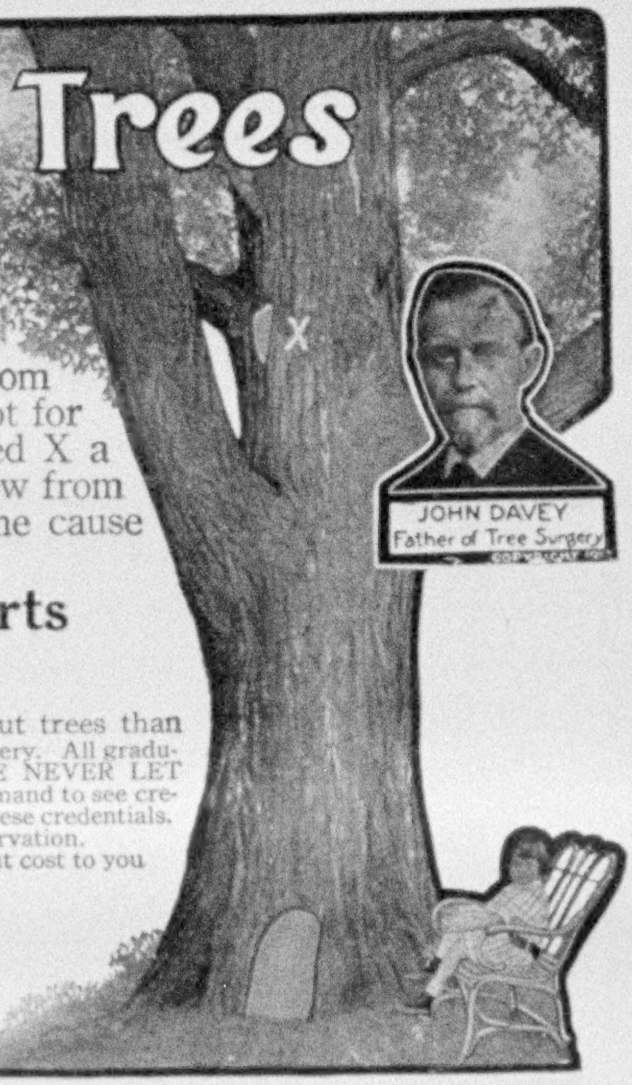

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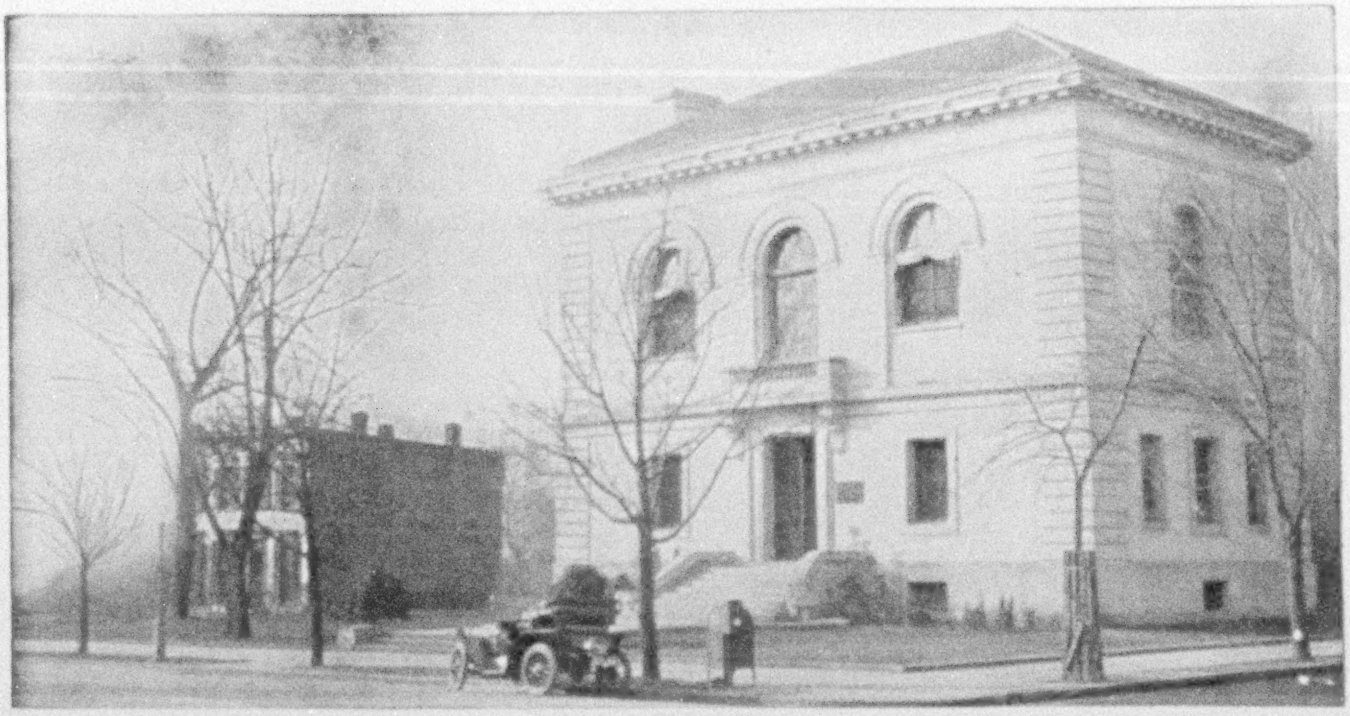

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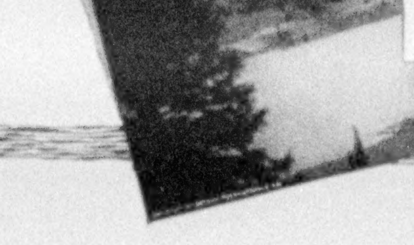

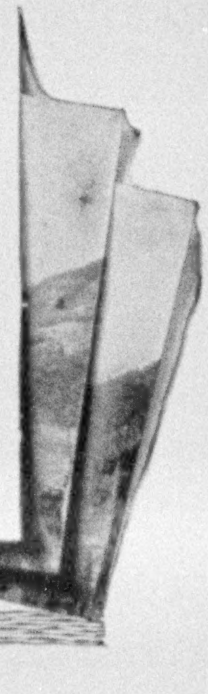

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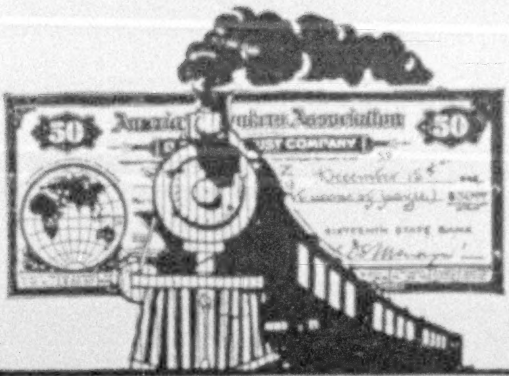

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VOL. XXIII, No. 7 WASHINGTON JULY, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

LITTLE-KNOWN PARTS OF PANAMA

BY HENRY PITTIER

AUTHOR OF "COSTA RICA—VULCAN'S SMITHY" IN THE NATIONAL GEOGRAPHIC MAGAZINE

THE usual tourist, fresh from a visit to the gigantic work now nearing completion between the cities of Colon and Panama, will tell of his occasional glimpses of the virgin forest and of his experiences with the natives, supplementing his narrative perhaps with pictures of the jungle and of what he took for aboriginal Indians.

In fact if our friend has followed the customary route, limiting his itinerary to a train ride from Colon across to Panama, with stops at Gatun and Pedro Miguel, to inspect the locks, and at Culebra to see the big cut, he knows very little of the real country, and in ninety-nine cases out of a hundred his native Indians are likely to have had kinky hair and African features.

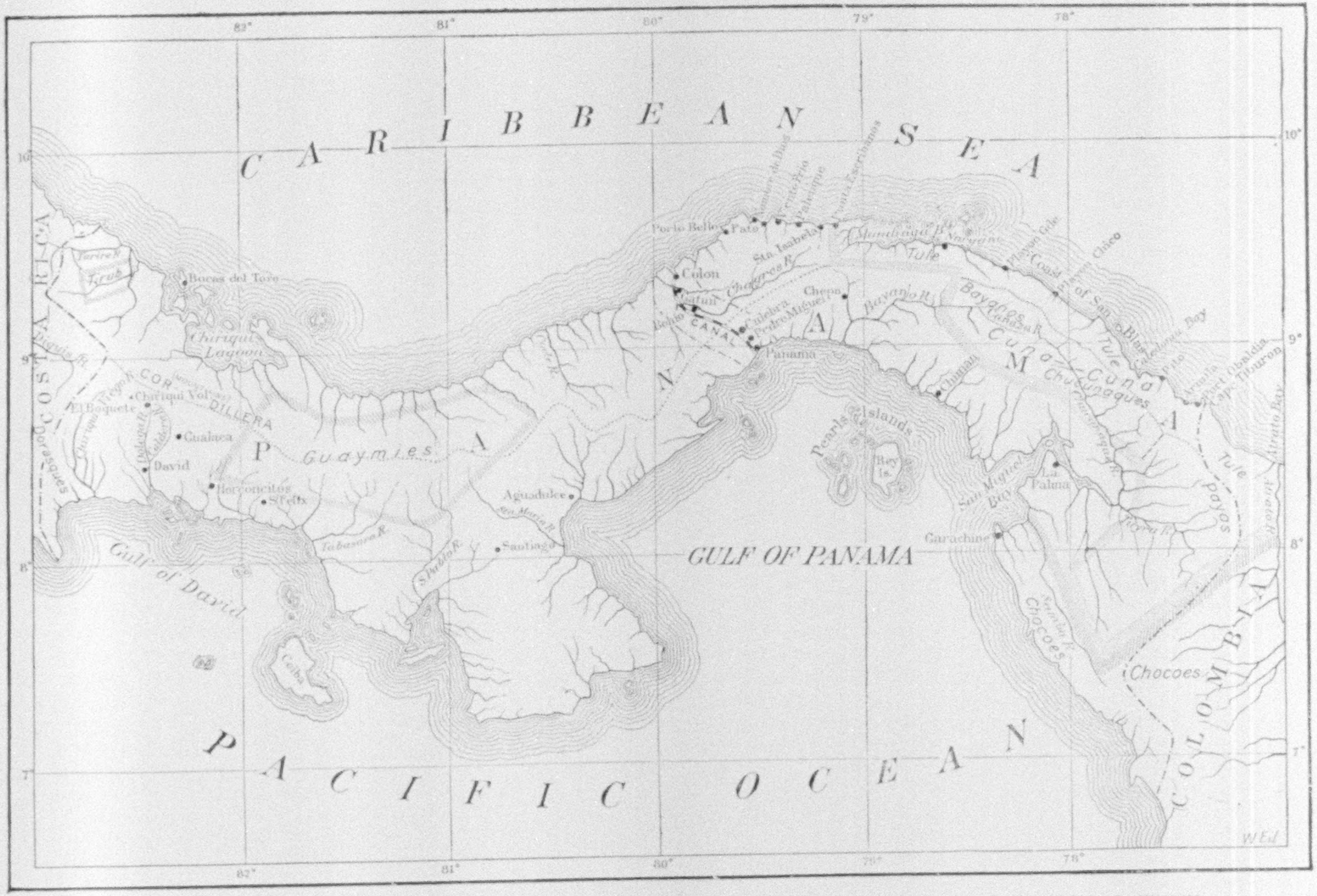
There is, undeniably, plenty of jungle and thicket along the future canal, but it is almost wholly second growth; and in those places where the primeval vegetation has been spared, as in the swampy lowlands between Gatun and Bohio and on the steeper declivities of the hills, it is and has always been more or less stunted and scarce and so does not give an adequate idea of the majestic forests that still cover about two-thirds of the territory of the Republic of Panama.

If, however, our tourist is a man of leisurely habits, a stranger to the hurried ways of the present generation, he may leave the beaten track, pick up the wanderer's stock, and go tramping over the excellent roads built parallel to the railroad and the canal by the government of the Canal Zone. He will then meet occasionally some last vestiges of the aboriginal vegetation and examples of the wonderful rankness of tropical plant life.

Not far from Pedro Miguel, on the way to Panama, stands a cluster of Cavanillesia trees, once part of the forest, but today shading a pasture (see picture, page 632). Apart from the striking effect of their huge straight trunks, which are out of proportion with their insignificant flat crowns, these particular specimens are of especial interest on account of the fact that they grow nearly at the extreme northwestern areal limit of the species. Eastward, in Colombia, it seems to reach the Magdalena River, and southward it can be followed along the coastal plains as far as Peru.

It may be interesting to add that the fruit affords a good example of the wonderful contrivances by means of which nature insures the propagation of the species. The fruit is an elongate spindle, provided with five broad wings and very light, so that it travels easily far away from the parent tree. The small seeds are imbedded in the woody tissue of the spindle, and the surrounding cells are filled with a gum which readily absorbs available moisture and swells to a

IUM



SKETCH MAP OF PANAMA, SHOWING GENERAL FEATURES AND PRESENT LOCATION OF ABORIGINAL TRIBES

considerable extent. When the fruit reaches the ground, the seeds thus find themselves at once immersed in an overflowing, gelatinous mass of gum, which furnishes the water necessary to the first stages of germination.

Another vegetable wonder that grows among the bushes on sandy flats along streams is often detected by the delightful odor and the yellow bright color of its singular fruits. It is the candle-tree, now introduced into most botanical gardens of the tropics, but a native of the central part of Panama.* The beautiful *Gustavia superba* should also be mentioned as a special feature of the Isthmian flora.

In thus wandering across country, instead of keeping exclusively to railroad trains, the traveler will have occasion many times to wonder at the incredible luxuriance of vegetable life in general and to observe the never-ending struggle for supremacy.

As to the real Indians, he may succeed in getting a look at some male specimen along the wharves at Colon or around the market in Panama City; but the chances are that they will mostly pass unnoticed in the motley crowd of mixed races of the larger towns. At least eight-tenths of the native inhabitants of the Republic show to a more or less marked extent the stamp of African blood, and the most extraordinary cases of inter-breeding are observed everywhere.

East of the canal, however, and not taking the aboriginal tribes into consideration, the negro element vastly predominates, the settlements of Porto Bello, Nombre de Dios, Palenque, and Viento Frio, on the Caribbean Sea, being formed, as it seems, by descendants of both West Indians and Spanish slaves, and the villages of the Pacific coast—Chepo, Chiman, Garachine—and those in the Tuyra basin by the latter only. West of the canal the predominance of the African element becomes less marked, at least on the southern side of the country, as one goes farther toward Chiriqui, where the whites and the civilized Indians have the upper hand.

Panama is hardly a country for mountaineering, most of its area being below the 3,000-foot contour line. The highest elevations are in the western part, which is an extension of the Costa Rican system. There the Chiriqui Peak, or Volcan de Chiriqui, as it is more commonly called, attains 11,000 feet and is worth ascending. Farther eastward and on the main divide several bold peaks can be seen from both coasts; they very likely reach the 10,000-foot line, but they have never been ascended and their exact altitudes, names, and even their true geographic position are still to be recorded.

The same can be said of the easternmost group of high ranges, on the Colombian border, an undeciphered mass of domes and peaks, which have never been explored and whose real relation to the western Cordillera of Colombia has never been ascertained. It is almost certain, however, that they form an independent system, and that the old notion of the South American Andes forming also the backbone of the Central American Isthmus should no longer appear, as it often does, in modern writings.

From the naturalist's standpoint these highest mountains at both ends of the Panamanian territory are of special interest. As few or no collectors have ever visited them, they are likely to be the abode of many unknown forms of both vegetable and animal life. They are also the most advanced outposts of the fauna and flora of the neighboring countries. Besides, they are attractive even to the ordinary tourist, on account of their beautiful scenery and of the marvelous changes observed within a few hours as one rises from the lower to the upper regions, experiencing at the same time a corresponding variation in climatic conditions. This is best seen in the ascent of the Chiriqui Volcano, the summit of which can be reached in three days from David, by way of El Boquete.

ASCENDING THE CHIRIQUI VOLCANO

David stands at about 12 miles from the seashore, in an open, slightly undulating country. It is one of the most rapidly improving towns of Panama, on account of the varied and abundant resources offered by the surrounding country and the affluence of foreign,

*See NATIONAL GEOGRAPHIC MAGAZINE, vol. xxiii, p. 124, 1912.

Photo by H. Pittier

A FOREST GIANT OVERLOADED WITH VINES, IN THE FOREST NEAR NOMBRE DE DIOS, PANAMA: NOTE THE MAN

mostly American, settlers. The tidal belt ends in the neighboring bottoms, and the plain between the sea and the first hills is subdivided into two or three terraces, the highest of which is about 150 feet above sea-level.

The deep ravines, cut through these terraces by the many streams descending from the mountains, allow an insight into the recent geological history of the district. Thick layers of a fine sand, almost horizontal and apparently devoid

of organic remains, show that the whole plain is an ancient sea-bottom, uplifted at a not very remote time either by some sudden cataclysm, or insensibly by the slow process that governs the emergence and subsidence of coastal lands all over the globe.

In former explorations, in the adjoining part of Costa Rica, I have noticed the same indications of a general upheaval, the neck of the Osa Peninsula still showing unmistakable evidences of a recent broad sea-channel, and bluffs, bearing the peculiar relief due to the action of the waves, lifted to nearly 300 feet above sea-level.

Most of the flat country about David is utilized as grazing land, and during the dry season it is constantly swept by the strong trade wind, reaching over the mountains through the deepest depressions of the Cordillera. Only in sheltered places along the rivers, behind the knolls that rise here and there, and around the houses, is there any show of arboreous vegetation, among the most conspicuous representatives of which may be cited the algarrobo and the corotú. The tamarind and mango, two East Indian trees now naturalized all over the tropics, and the native wine and plum palms, are the trees most generally seen around the houses. Extensive forests, displaying the luxuriance and generous proportions of real tropical vegetation, are found only at some distance to the west, on the lands adjoining the Chiriqui Viejo River, or to the east between Gualaca and Horconcitos.

Going north in the direction of the Chiriqui Peak, one is soon struck by the peculiar range of low hills running, as it seems, between the plains and the mountains and parallel to the sea-coast. The road winds between these and, mostly following the Dolega River, ascends gradually toward El Boquete. The general incline is so insensible that one travels nearly 25 miles before reaching the foot of the volcano, at an altitude of about 3,000 feet. The ride is mainly across savannas or through what ecologists call a parklike landscape.

During the dry season the long stretches, bare of arboreous vegetation, are constantly swept by the north trade wind, which attains its major intensity between 9 o'clock a. m. and 3 o'clock p. m., and is often of such violence that even the horses find it difficult to stand and to proceed on their way. Every detail of the surrounding landscape bears the impress of the wind. In the most exposed places the surface of the soil is submitted to an active aërial erosion, the minute particles of the ground being whisked away the moment they become loose.

The meager sod is characteristic in appearance, consisting not of a continuous carpet of grasses, as in most savannas, but of isolated tufts of sedges and small plants (mainly Leguminosæ and Rubiaceæ), distinguished by the unusual development of their root system.

Many an acre is absolutely bare, and at places long stretches of stones, running from north to south, are explained by the natives as being remnants of former eruptions of the volcano. They are really what is left of low ridges demolished by the wind.

In hollow places, as along the dry bed of creeks that flow only during the wet season, the trees show some attempts at congregating in small groves; but they have a stunted appearance, their trunks are twisted and knotty, their limbs few, and all strikingly growing in a southerly direction (see page 636).

The few head of cattle browsing through these thinned savannas are shaggy, and even the people and their dwellings, the former with their large hats tied upon the head and the latter with roofs half gone or mended temporarily with the leaves of the native royal palm, show the permanent action of the wind.

Not to impress the reader too deeply with the dreary barrenness of the country, it should be added that the south-side exposures of the hills and the deeper valleys offer sheltered nooks, with prosperous villages surrounded by patches of grassy pastures and of forests.

Through this rather desolate region several rivers have cut deep, narrow canyons, in which subtropical vegetation is mixed in a curious way. Oaks are seen growing next to palms, giant elms

XUM

Photo by H. Pittier

CAVANILLESIA LANDSCAPE NEAR PEDRO MIGUEL: CANAL ZONE

Besides their interest as a remnant of the primeval forest, these trees grow nearly at the extreme northwestern areal limit of the species, which is mainly a feature of the South American Pacific coast (see page 627)

mingling their branches with those of towering ficus, and, among herbaceous plants, clematis and nettles side by side with showy bignonias and fragrant epiphytic orchids. Bathed in the perpetual but never excessive dampness of the foaming river, sheltered from wind and strong nightly radiation by the high surrounding walls, and with an atmosphere incessantly renewed, the hidden recesses of these gorges assume, indeed, a singularly beautiful appearance. They are, however, difficult of access, and not only teem with insect life, but offer favorite refuge for snakes, which are attracted by the latter and by the many small mammals.

Near El Boquete the road leaves the savannas to penetrate into the upper Caldera Valley. This is the favorite summer resort of the Panamanians and of many Canal Zone Americans, and also the only coffee-growing section of the whole Republic. On account of the prohibitive tariff, the latter is one of the best paying products of native agriculture, and several foreigners have established here prosperous plantations. But El Boquete, half in the windy, semi-arid zone and half in that of continued rains, has a very limited producing capacity, and cannot by far supply the rapidly increasing coffee consumption of the larger centers. It is not equipped, either, for a summer resort, as the "Hotel de Lino" is simply a farmhouse, where abundant meals and a kindly hospitality are the welcome but sometimes inadequate compensations for the lack of worldly comfort.

To the lover of nature, however, the surrounding forests are forever a source of healthy enjoyment, among which orchid hunting is not the least exciting. Several of the most highly prized species hide on the moss-grown trees, and often their exquisite perfume is the only indication of their near presence. Now and then the eye is attracted by white or pink patches of Trichopilias, or by the curiously shaped although less conspicuous flowers of some Catasetum (page 641).

The visit to the Chiriqui Volcano is usually made from here. It is an 8,000-foot ascent to the top and is scarcely to be recommended to ladies. Not that it offers any danger or even chances of dramatic situations, but it is a straight and exhausting climb, rendered difficult at times by the unsteadiness of the loose soil, the intricate thickets, and, even in the upper belt, by high, tangled grass-fields. Rocks, all of volcanic origin, are seen only in deep gorges or near the top; snow and ice are out of the question; and, though still called a volcano, the Chiriqui Peak is a dead one, in which only obsolete traces of former plutonic action are to be seen.

Still, the ascent is worth while, if made at the right time. The trail leads first through savannas and beautiful oak forests, mixed with sweet cedars and other subtropical trees, and as it goes higher and higher, always straight toward the top without any superfluous windings, the attention of the traveler is distracted from his toilsome physical exertion by the successive appearance, in the middle of a strange vegetation, of many familiar-looking plants, like trailing bramble vines loaded with luscious blackberries, less welcome nettles, just like those seen around old farm-houses in northern climates, alders, and the like. A formal investigation of the flora of the upper mountain belt would show, in fact, that it is a mixture of a reduced endemic element with representatives of the flora of our northern countries and of the South American Andes.

It may be interesting to mention here that along the trail, between two and three thousand meters of elevation, there are whole forests of a Persea tree, which is a very near relative to the alligator pear. It grows below and above the frost-line, and we have repeatedly advised its acclimatization in California, where it could perhaps be used as a grafting or budding stock. On account of its hardiness, it is not unlikely that by its means the extreme limit of alligator-pear cultivation could be shifted a good distance northward.

The long ascent to the top is not made in one day. There is a first camp in a picturesque gorge, about half way up from El Boquete, and then another at the bottom of the large northern crater,

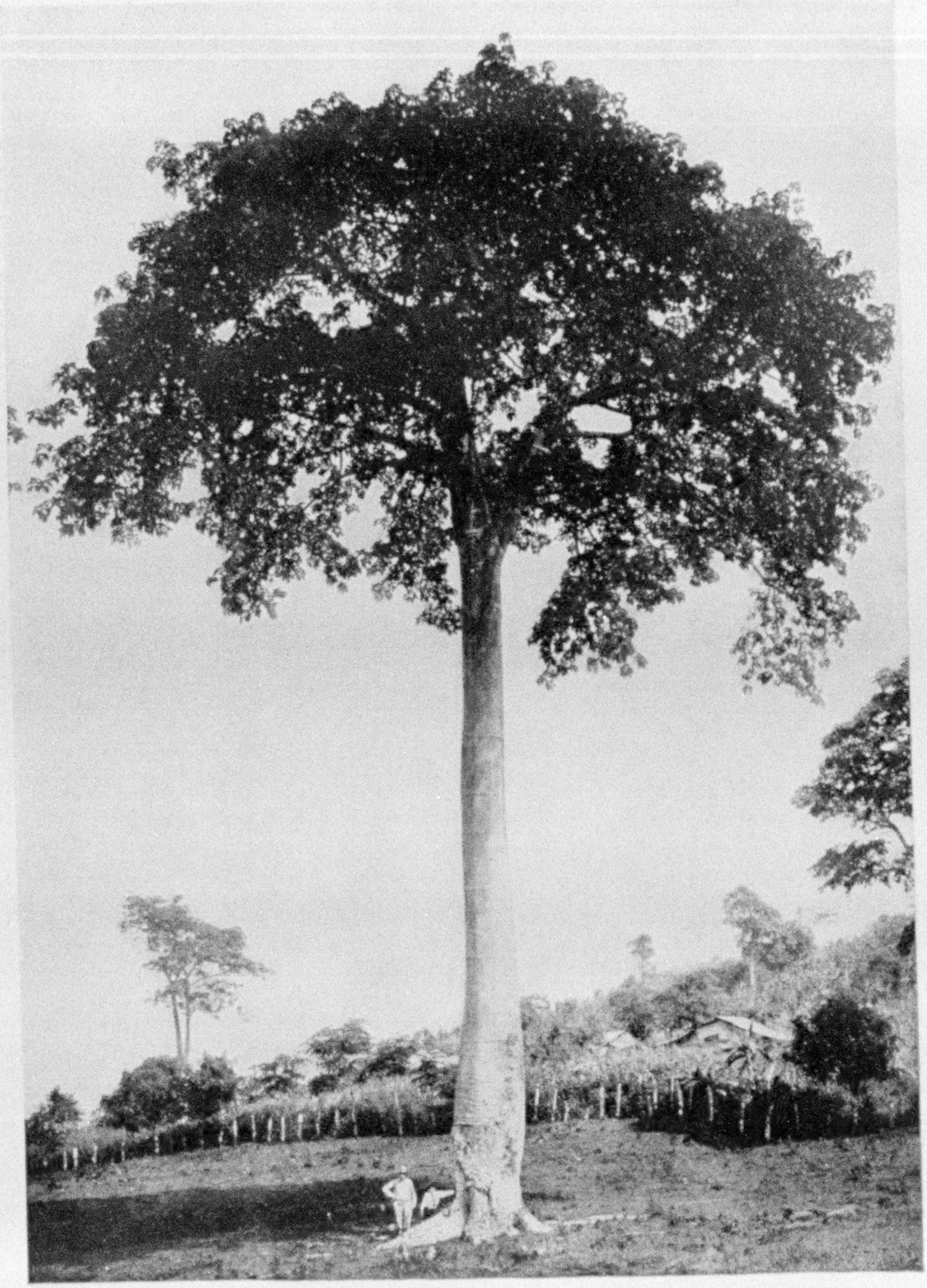


Photo by H. Pittier

Cavanillesia platanifolia, ONE OF THE MOST BEAUTIFUL TREES OF THE ISTHMUS
The wood, however, is spongy, as light as cork, and apparently useless

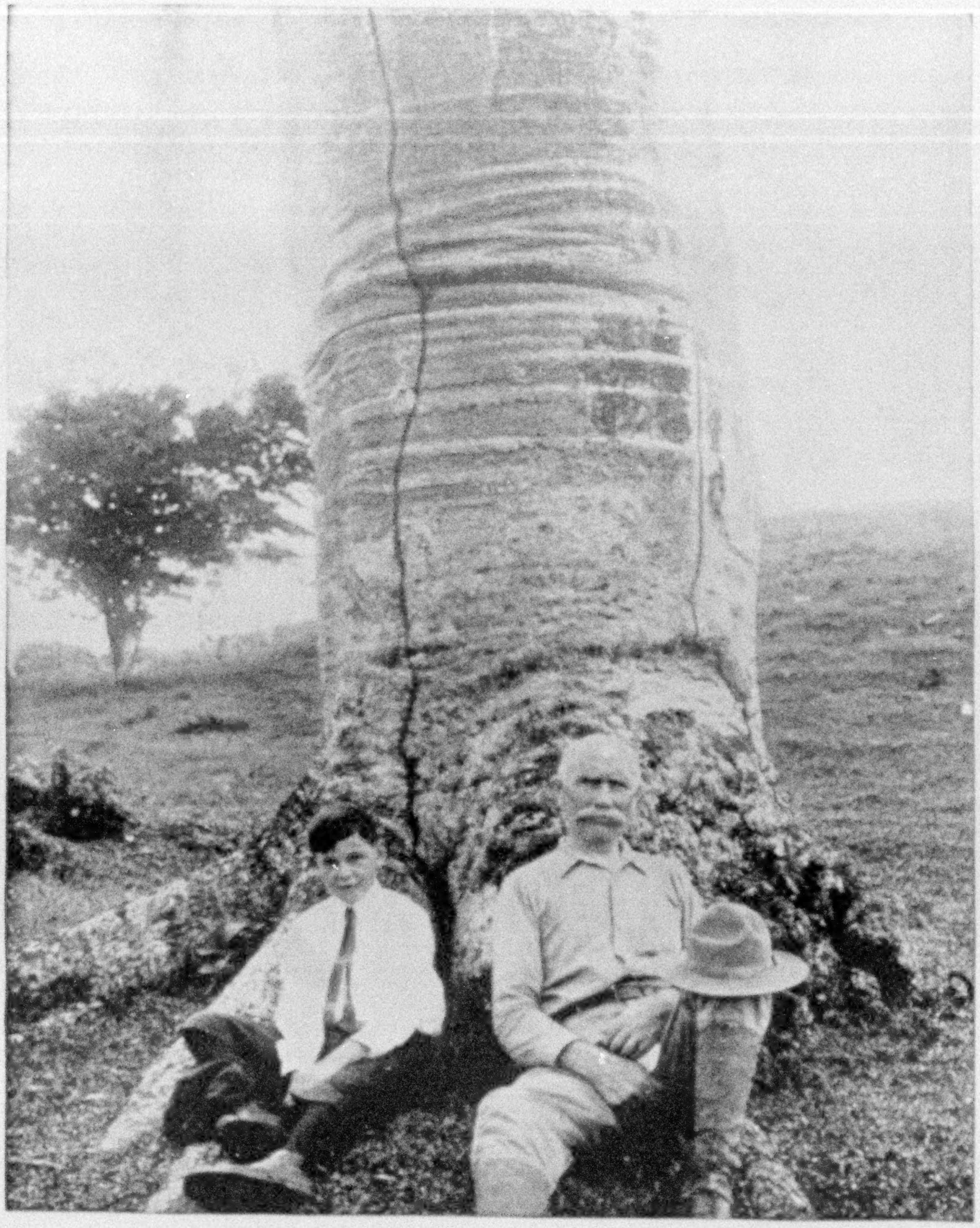


Photo by H. Pittier

Cavanillesia platanifolia, THE CUIPO-TREE

The two vertical dark lines are termite tunnels, showing that not even these giants of the tropical forest are safe from the attacks of the destructive white ant. The boy at the left is the author's son and companion.

in one of the nooks formed by the narrow gorges leading to the highest summit. Here the temperature goes every night near or below the freezing point, and the cold is very intense to people accustomed to the heat of the lower plains.

But during the dry season the air is so crisp and pure, the sky so blue, the song of the thrushes and of many other familiar little birds so pathetically lovely, and the beautiful surrounding nature so exhilarating, that one easily forgets small bodily inconveniences to enjoy with full heart the beauty of it all.

The crater is a circular plain about 2,000 feet in diameter, surrounded by a more or less broken ridge that is densely covered with a forest of myrtles, oaks, and less familiar trees. The culminating peak is distant only about two hours' climb, and as one approaches it the arboreal vegetation becomes more and more stunted and dwarfed, until it completely

Photo by H. Pittier

THE TREE-LIMBS ARE ALL STRIKINGLY GROWING IN ONE DIRECTION (P. 631)

disappears, to give place to rocks and grassy slopes.

In clear weather the panorama from the summit is splendid: to the south, the vast expanse of the Pacific and the beautiful lowlands of Chiriqui, all interlaced forests and savannas; to the north, a labyrinth of unexplored valleys, covered totally by virgin forest running down to the Caribbean Sea; westward, the Costa Rican mountains familiar to the writer; and to the east, many a lofty peak of no despicable prominence and virgin yet of any white man's footprints. In our ascent we had only glimpses of all this, as a thick fog was gathering at the time. From the top we had only a momentary vision of a far-looking silvery ribbon, the Rio Chiriqui Viejo, several thousand feet below us to the west.

The return trip can be effected easily in one day.

THE ABORIGINAL TRIBES OF PANAMA

Our tramp through Panama now takes us to scenes quite different from those we have just described, among what is left of the aborigines of the country.

In the years 1501 to 1503, when Rodrigo de Bastidas and Christopher Columbus visited the northern coast of the Isthmus, they found it densely populated. About ten years later Balboa met with identical conditions along the southern coast, and all subsequent reports of early explorers give evidences of the fact that the whole country was in possession of numerous clans, the names of many of which have been preserved.

The two principal nations were the Guaymies, extending from the Chiriqui Volcano eastward to what is today the Canal Zone, and the Cuna-Cuna, on the opposite side of the Isthmus. West of the volcano, in the valleys of the Chiriqui Viejo, Chánguena and Diquis rivers, and possibly a little farther east, along the Pacific Ocean, were the Dorasques, a warlike and more civilized race, to whom the beautiful pottery and the gold ornaments found in the ancient graves of Chiriqui are often attributed. As can be deduced from these relics, the Dorasques had trade relations with the Niquirans and Chorotegans, of Costa Rica, and through them felt in some degree the influence of the Nahuatl, in far-away Mexico. Today they have completely disappeared as a tribal entity.

On the southeastern border of the present Republic of Panama dwelt the Chocoes, who are still numerous and extend from the Pacific coast northward to and even beyond the Atrato River. They formed a kind of buffer state between the Central and South American nations.

In the course of my work I had the opportunity of spending many weeks among representatives of the three groups still in existence—that is to say, the Guaymies, the Cuna-Cuna, and the Chocoes.

THE GUAYMIES

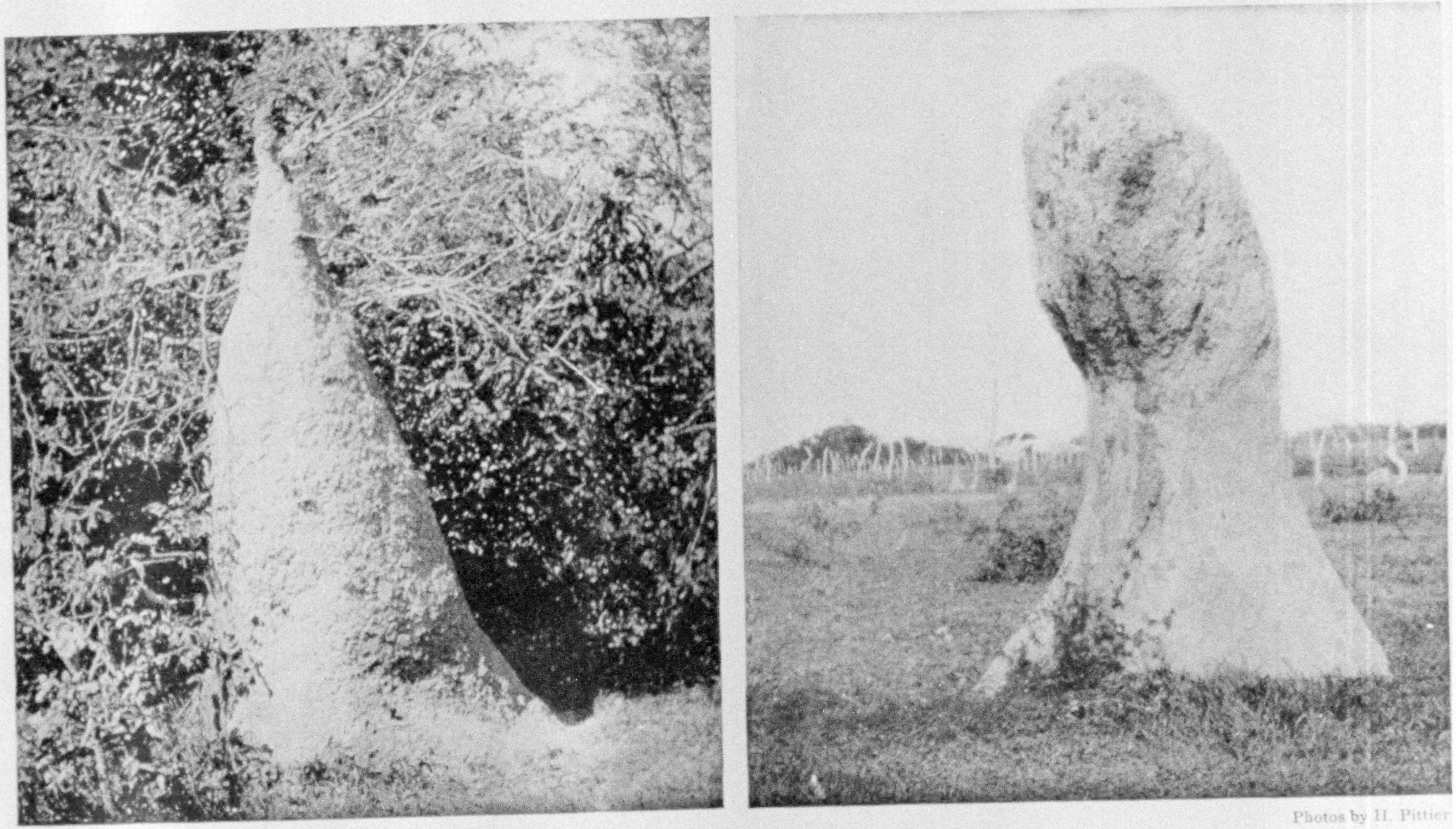
Up in the forbidding mountains and valleys that form a background to the landscape for the traveler on the steamers plying between Panama and David dwell the mass of the present Guaymies, about 5,000 in number, in their homes scattered through savannas and forests. From the time of the conquest to the beginning of the past century, they have been more or less under the influence of Catholic missionaries, but have since been left to go back to most of their ancient customs and ways of living.

Among the few vestiges left of that transitory semi-civilized condition under

Photo by H. Pittier

A BUNCH OF FLOWERS OF *Gustavia superba*, ABOUT ONE-SEVENTH OF THEIR NATURAL SIZE

XUM



Photos by H. Pittier

TERMITE NESTS IN THE SAVANNAS NEAR AGUADULCE (VERAGUAS), PANAMA

They are built originally around the stem of some young tree, which soon disappears, while the solid, dolmen-like columns stand indefinitely against wind, rain, and drought

Photo by H. Pittier

PROVISIONAL SUMMER ROOF, MADE OF THE LEAVES OF THE NATIVE ROYAL PALM (*Attalea gomphococca*): NOTE THE LONG PALM LEAVES

religious discipline, perhaps the most conspicuous is the flowing gown of the women, tight at the neck and reaching down to the feet. In every aboriginal tribe committed to their guardianship the first care of the pious fathers seems to have been to create among those simple creatures not the sense of modesty which is innate among them, but a feeling of shame of their physical beauty.

This is why in countries with a constantly warm climate, and where the rugged topography, the predominance of brush and bush, and the multiplicity of rivers make necessary only the scantiest clothing, we often see the poor females moving awkwardly in their cumbrous imposed garments, under which, however, they still wear the primitive and more practical bark skirt. It is true that when there is no stranger near the gown is mostly discarded, and if a rain-shower surprises a caravan on the trail the women quickly strip, wrap their togs in a large Calathea or Heliconia leaf, place the parcel in their load, and then continue on their way.

The men do likewise, and besides when they go on a hunting expedition they invariably abandon their trousers before starting on a run after some wild animal. This practice has been adopted by the other more civilized native in some parts, and sometimes one discovers a whole collection of blue trousers hanging on the lower branches of some tree at the opening of a forest path. In this case the shirt that forms the only other part of the male wearing apparel is taken off and tied around the loins.

The Guaymies are usually not of a very prepossessing appearance. Their stature is rather variable and their bearing has not the stateliness that is often noticed among other Indians. Among the men the face is seldom attractive. The lips are usually thick, the nose is flat and broad, and the coarse black hair worn short (see page 644).

Among the women a few were met

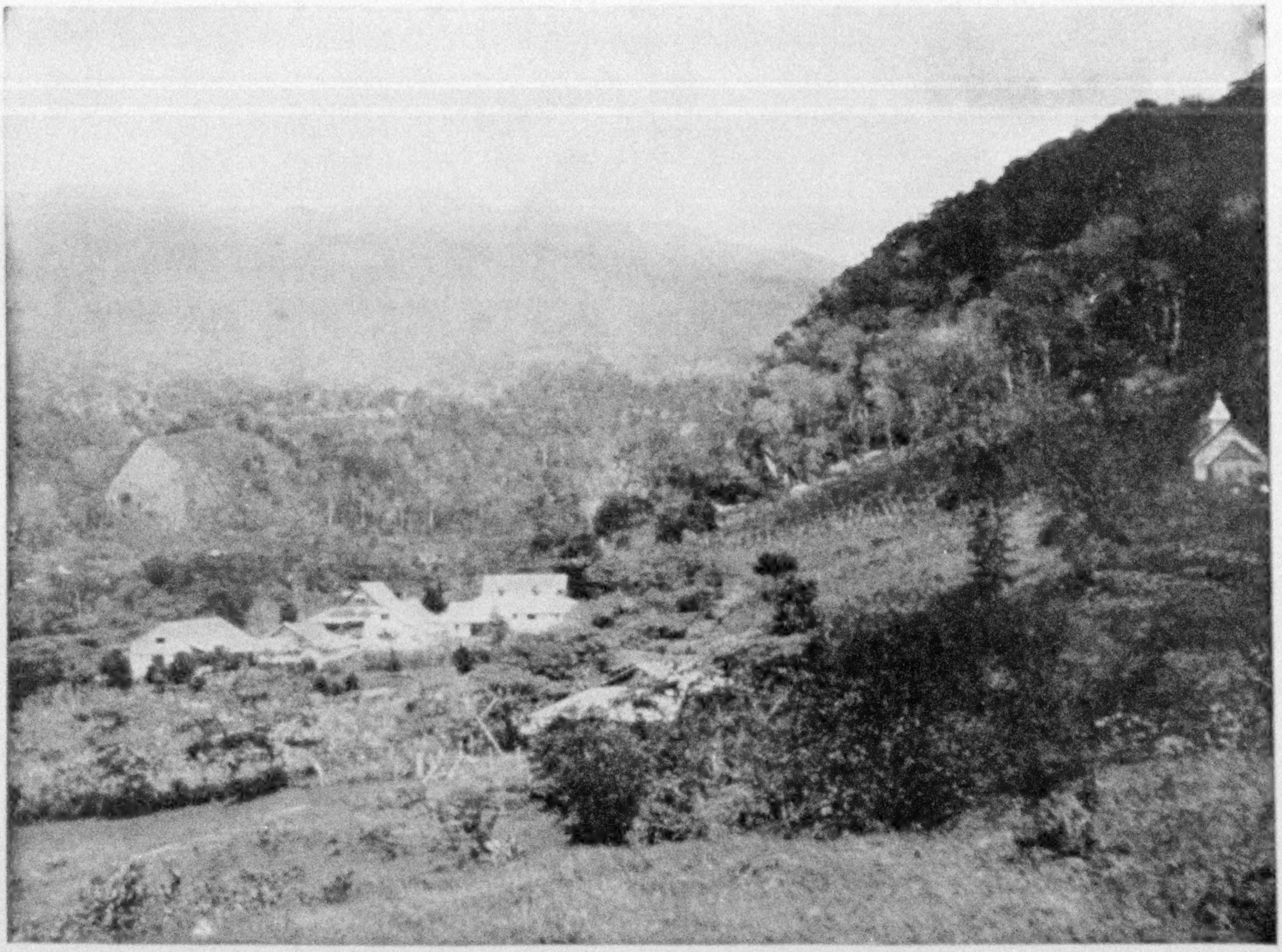


Photo by H. Pittier

EL BOQUETE, SUMMER RESORT OF THE PANAMANIANS, WITH THE CLOUDED CHIRIQUI VOLCANO IN THE BACKGROUND (SEE PAGE 633)

with who were positively pretty and—is it necessary to say?—knew it. But beauty is not at a premium among the Guaymi females. A woman ought first to be strong, healthy, and a good beast of burden and day-worker. The children, especially the little girls, also have frequently lovely faces, with a warm brown, velvety skin and beautiful eyes. When they reach the age of puberty their hair is cropped short and not allowed to grow again until the first baby is born. Maidenhood, however, is a short stage of life for the Guaymi women, who not infrequently become mothers before having reached their twelfth year.

Face painting is a common practice, restricted apparently neither by age nor sex, although the women adorn themselves thus only on great occasions. Black, red, and white are the favorite colors, the latter being obtained, as I have been told, by the use of an ordinary oil-paint, which the Guaymies obtain at Bocas del Toro. Little girls keep their faces clean, but boys under twelve were seen with broad black blotches, without definite outline, around their eyes.

In men the decoration is always more elaborate, and certain peculiarities in the patterns, as well as the exact repetition of these by distinct people, lead to the belief that they had formerly and may still have a significance as a totemic or tribal emblem. The groundwork almost always consists of two black lines starting obliquely downward from between the eyes, so as to form on the face a broadly open Λ, the apex of which is on the nose ridge. These black lines are variously supplemented by white or red parallels, terminal appendages, and the coloring in pink, by means of anatto, of the outline of the lips, which then appear much thicker than they naturally are.

In certain communities the wealth of people is estimated by the number of

Photo by H. Pittier

THE CURIOUSLY SHAPED FLOWERS OF *Catasetum scurra*, REDISCOVERED IN PANAMA BY MRS. H. H. ROUSSEAU (SEE PAGE 653)

The yellowish-green perianth is purple striated, with a delicately fringed labellum

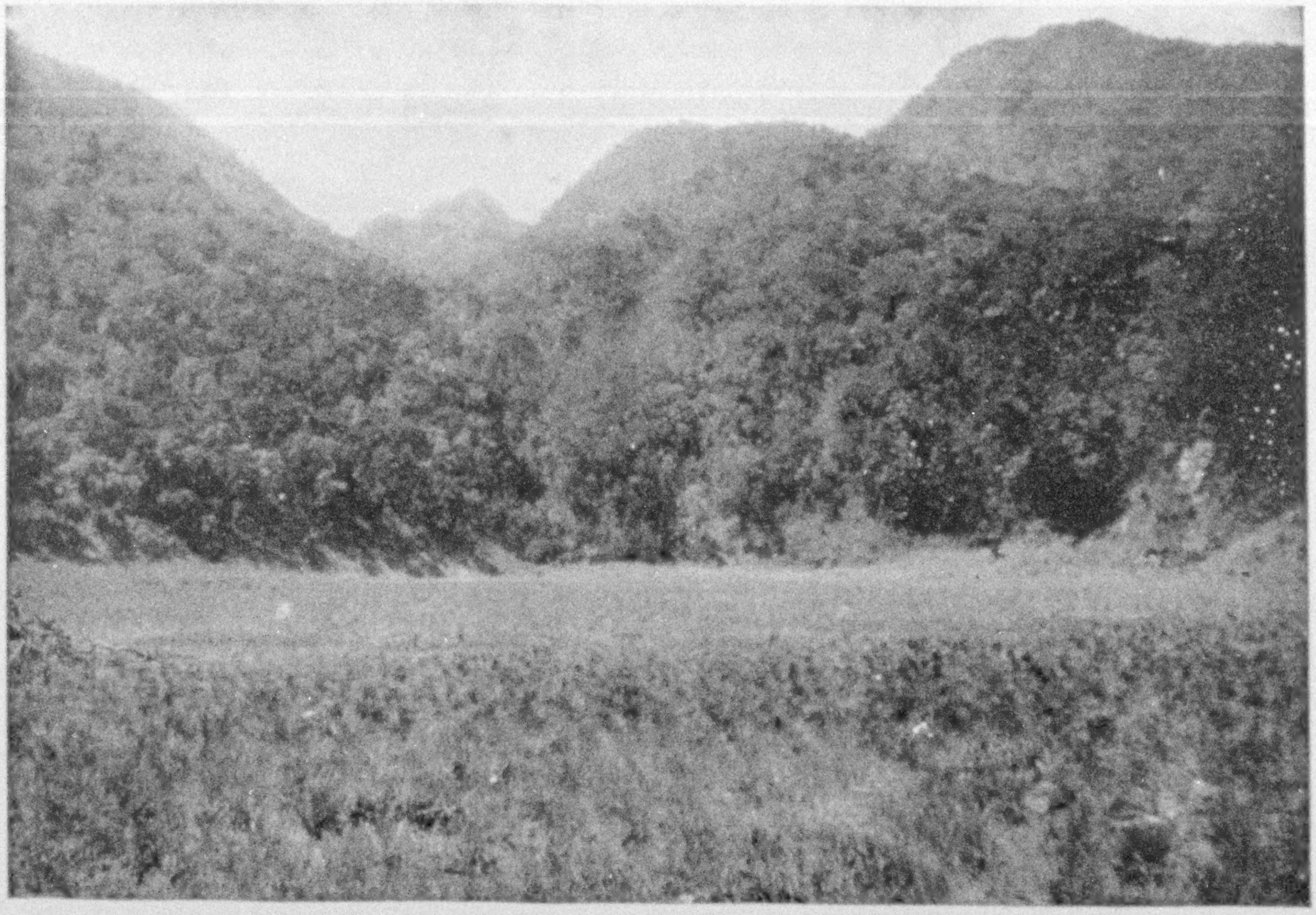


Photo by H. Pittier

THE ANCIENT CRATER IS NOW A GRASSY PLAIN SURROUNDED BY DENSELY WOODED HILLS (SEE PAGE 635)

their cattle. Among the Guaymies the number of wives is the standard. The rôle of these in the domestic economy is not, however, merely that of a toy, as among certain Oriental nations. They constitute the working capital of the family, and their way of courting the preference of their master is not through love, but toil. Even thus, and though they are little more than mere beasts of burden, they seem to be quite satisfied with their lot, and it will be a long time before they feel the need of joining in the throng of modern aspirants for sex equality.

The typical Guaymi dwelling is a round house, about eight meters in diameter, with a conical thatch roof. The bare ground constitutes the floor, and the fireplace is either in the middle or at the side. These houses are not always walled. When they are they have no windows, but two doors placed at the opposite ends of a secant to the circumference of the structure. The walls are made of erect sticks brought close together and tied with vines. On the north side plaster made of cow dung and clay is sometimes applied so as to afford a protection against the wind (see page 646).

Benches along the walls are used as beds, although at high altitudes, where the temperature is often very low at night, the resting place is on a light floor just under the roof. Large nets, hanging from the beams, are used in lieu of wardrobes and closets, and the tilling, fishing, and hunting implements, all of a primitive type except the guns, complete the house furnishings. Nowadays the kitchen crockery is mostly imported ware, the only exceptions being the large earthen jars used to keep the *chicha*, or corn-beer, and the calabashes, of universal use in the tropics.

Their dwellings are located either in the midst of the forests of the lower belt, in solitary clearings far apart, or in the high savannas. In the first instance they are always at some distance

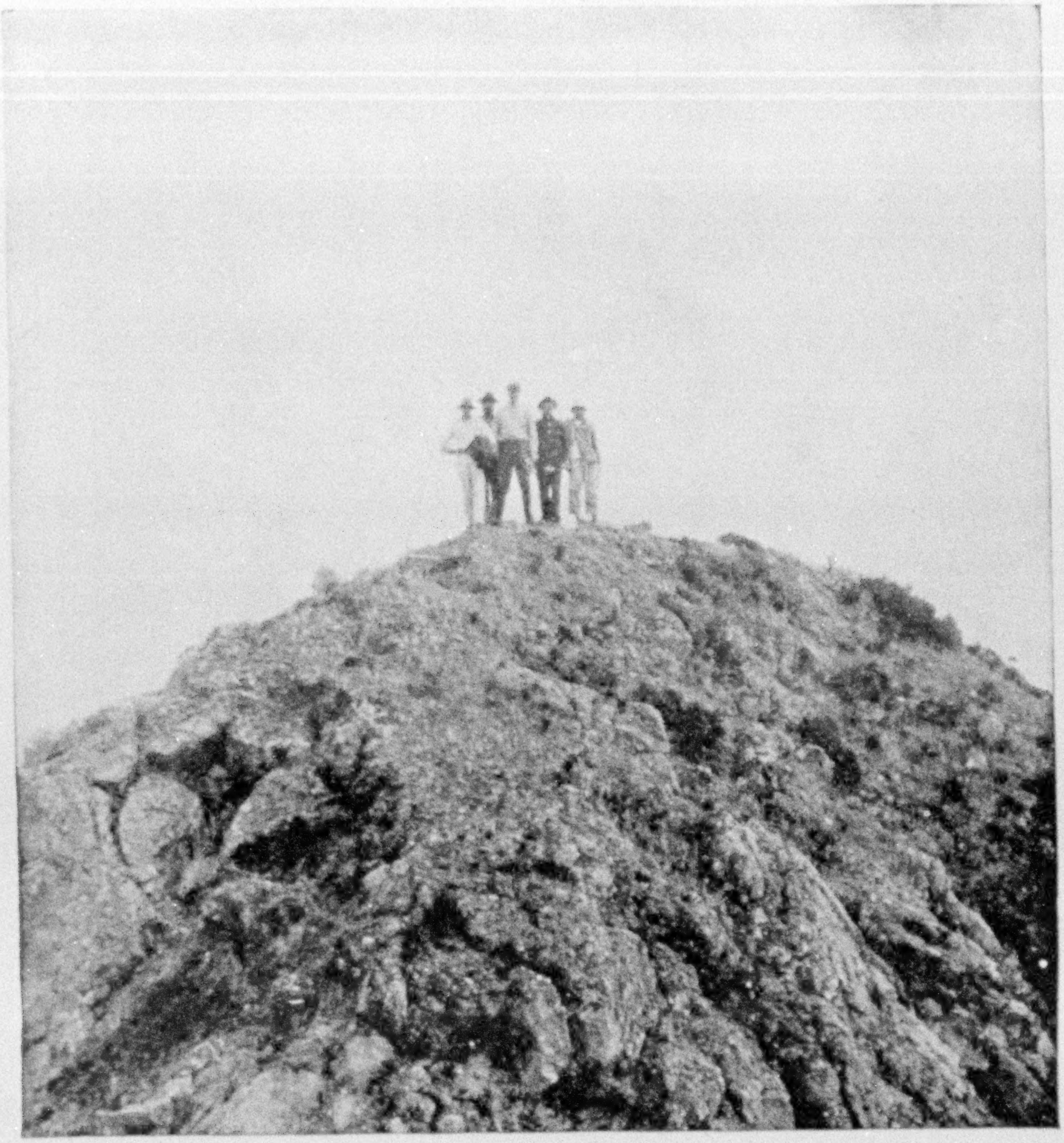


Photo by H. Pittier

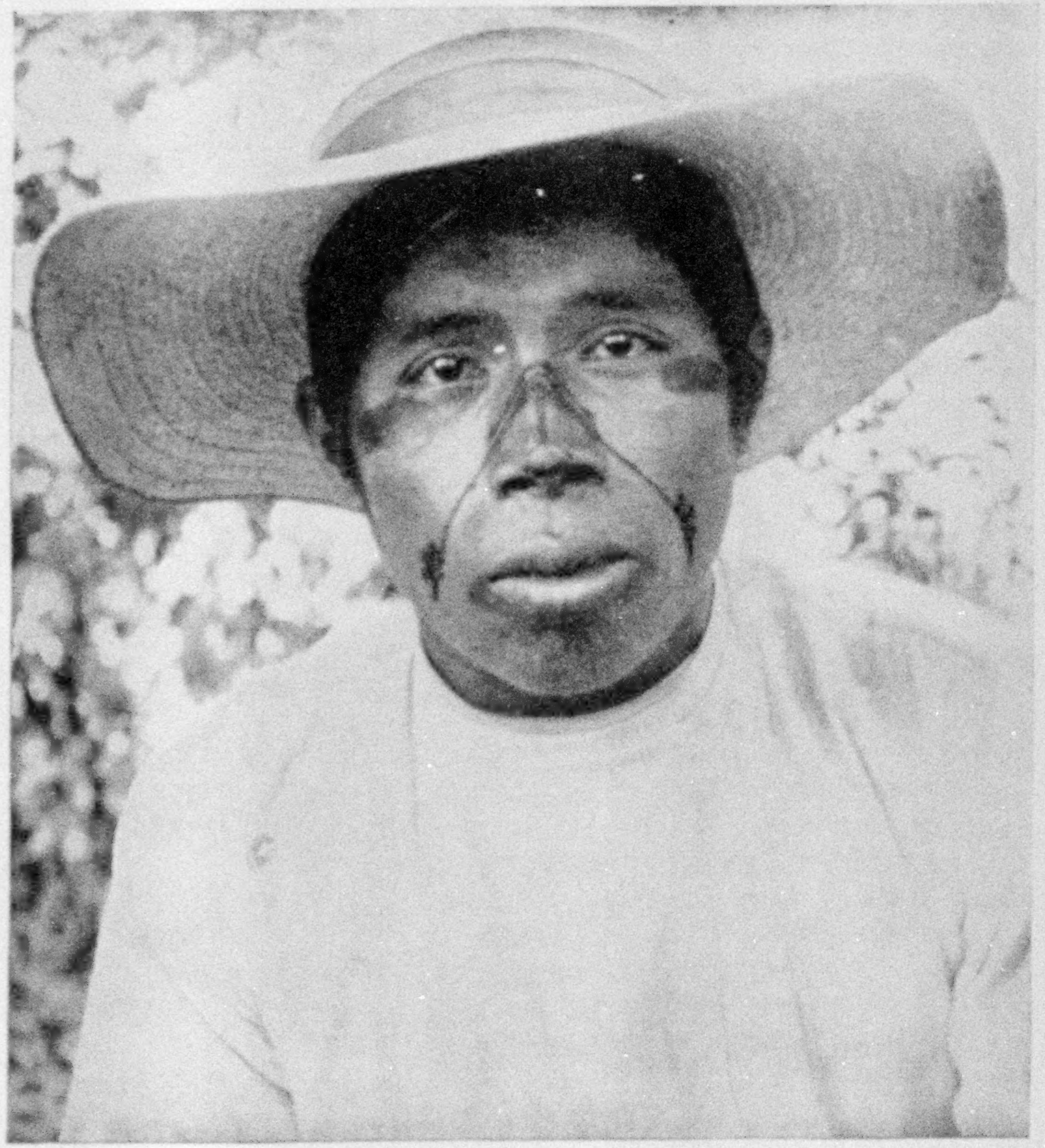
THE TOP OF THE CHIRIQUI PEAK, THE HIGHEST POINT IN THE REPUBLIC OF PANAMA (11,000 FEET) SEE PAGE 636

from the sea, as the Guaymies, forced back into the mountains by the Spanish invaders, have long since lost the art of navigation.

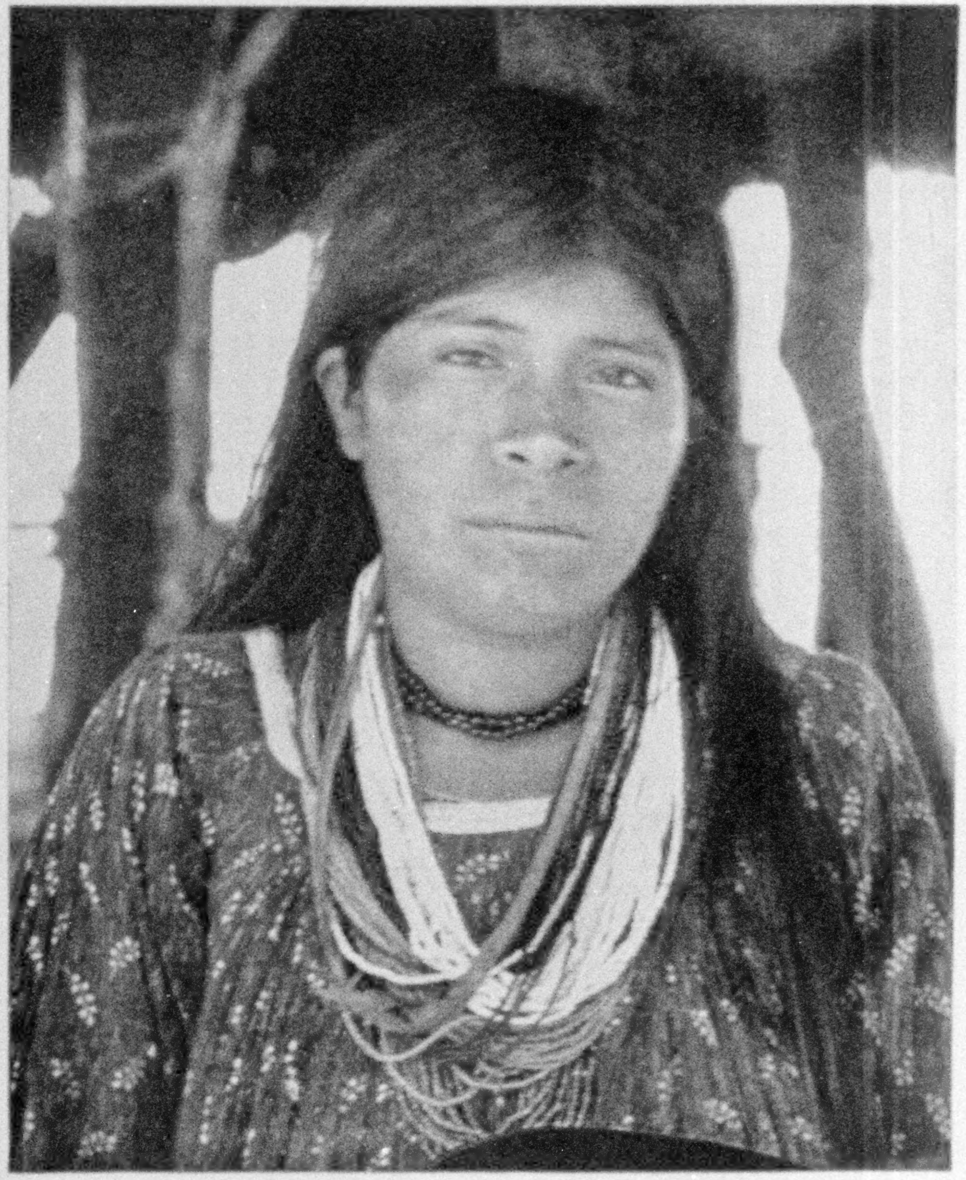
These forest dwellers are of a quieter and more submissive disposition, though their daily contact with the stealthy and hidden animal life of the woods has made them more cunning and distrustful than their brothers of the savannas. These, living amidst rugged hills, in a relatively cold climate, and enjoying day after day the magnificent panorama of the surrounding mountains and plains, framed in gray clouds and blue waters, are more energetic and open, and also proud of their undisputed independence.

THE CUNA-CUNA OR SAN BLAS INDIANS

According to historical records, confirmed by tradition and by a few local names, the Cuna-Cuna extended formerly as far as the valleys of the eastern reaches of the Chagres River, and covered both sides of the continental divide between the present Canal Zone and the



AMONG THE GUAYMI MEN THE FACE IS SELDOM ATTRACTIVE: THE LIPS ARE THICK, THE NOSE IS FLAT AND BROAD



Photos by H. Pittier

A GUAYMI INDIAN
(SEE PAGES 636, 639, AND 640)

bays of San Miguel and Atrato. In the course of the conquest they offered a steady and stubborn resistance, and, though they have been gradually deprived of a large part of their former territory, it is certain that to this day they never have been really subjugated.

Photo by H. Pittier

THE LITTLE GUAYMI GIRLS OFTEN HAVE SWEET FACES AND BEAUTIFUL EYES

The history of the last four centuries shows not only many instances of their bloody struggle against the hated invader, but also proofs of their ability for political intrigue. During the piratical warfare of the buccaneers, or free-booters, the Cuna-Cuna were their constant allies against the Spaniards, because they well understood that while the latter had come to stay, the former had no idea of securing a permanent foothold in the Isthmus.

When in 1698 Patterson landed on the beach of Caledonia Bay with his small army of settlers, the Cuna-Cuna received him with open arms, readily ceded the required portion of their land, and were to the end the trusted and trusting allies of the luckless Scotchmen.

Today, after 200 years, the natives of the San Blas coast still keep in their heart a warm feeling not only for the latter, but for the British in general. The late Queen Victoria is revered among them almost as a divinity, and even vested by some with the attribute of immortality. Two or three times, indeed, during my short stay among them, I was asked the question: And Queen Victoria—how is she? And my assertion that she had been dead for several years was always received with the utmost incredulity.

Their diplomacy has been shown further in the course of recent events, when the secession of Panama was followed by the advent of the Americans in the Canal Zone, who from the beginning have been looked upon by the Indians as new and formidable conquerors, more dangerous to their race than the Spaniards of old. Such an impression, originating in reports from the Colombian side, could but be confirmed and intensified by the many men of Nárgana, Urgandi, and other places along the coast, who had repeatedly come to this country and stayed in it for longer or shorter intervals, thus becoming eye-witnesses of its might and irresistible power.

So the San Blas people were thoroughly awed, and, as they distrusted the capacity of little Panama to give them the protection they needed, they turned to their former masters, for whom they felt all at once a love and loyalty which years of involuntary and passive submission had not been able to foster.

The venerable chieftain Inanaquina undertook the long voyage to Bogota to

Photo by H. Pittier

GUAYMI HOUSE IN THE FOREST: NEAR BY IS A CLEARING, WHERE PLANTAINS, YAMS, CASSAVA, AND OTHER FOODSTUFFS ARE GROWN (PAGE 642)

put himself and his people under the protection of the Colombian government. He never reached the goal, however. His adviser and interpreter having died of smallpox at Honda, the frightened old man turned in his tracks and succumbed to the same disease in Cartagena.

It was then that a serious blunder was made by the new régime at Panama. The hereditary successor of Inanaquina was his nephew, Inapaquina, and following the news of the former's demise, he was effectively proclaimed as such and acknowledged in most villages. The Panamanian government, however, ignoring the respected tradition, appointed as supreme authority on the whole coast Charlie Robinson, a native of Nárgana, who as a child and young man had spent many years in the United States and fulfilled perhaps better than any other one the desired conditions for the office, but who, in the eye of the Indians, had no right to it.

This resulted in a splitting of the community, the more conservative part of which, from Playon Grande eastward, continued under Inapaquina and the Colombian flag, while the Mandinga Bay natives indifferently accepted the rule of Robinson. Thus inopportune intervention has resulted mainly in the awakening among the majority of the San Blas Indians of a warm feeling in favor of Colombia.

The often circulated reports of the difficulty of penetrating into the territory of the Cuna-Cuna are true only in part. The backwoods aborigines, in the valleys of the Bayano and Chucunaque rivers, have nourished to this day their hatred for all strangers, especially those of Spanish blood. That feeling is not a reasoned one: it is the instinctive distrust of the savage for the unknown or unexplicable, intensified in this particular case by the fear of reprisal for injury or crime committed on several instances,

Photo by E. D. Christopherson

THE CUNA-CUNA OR SAN BLAS INDIANS ARE OF SMALL STATURE: PANAMA

Photo by E. D. Christopherson

SAN BLAS (CUNA-CUNA, OR TULE) INDIANS OF SHIATINAKA

Note the heavy gold disks hanging from the ears of the man on the left (see page 655)

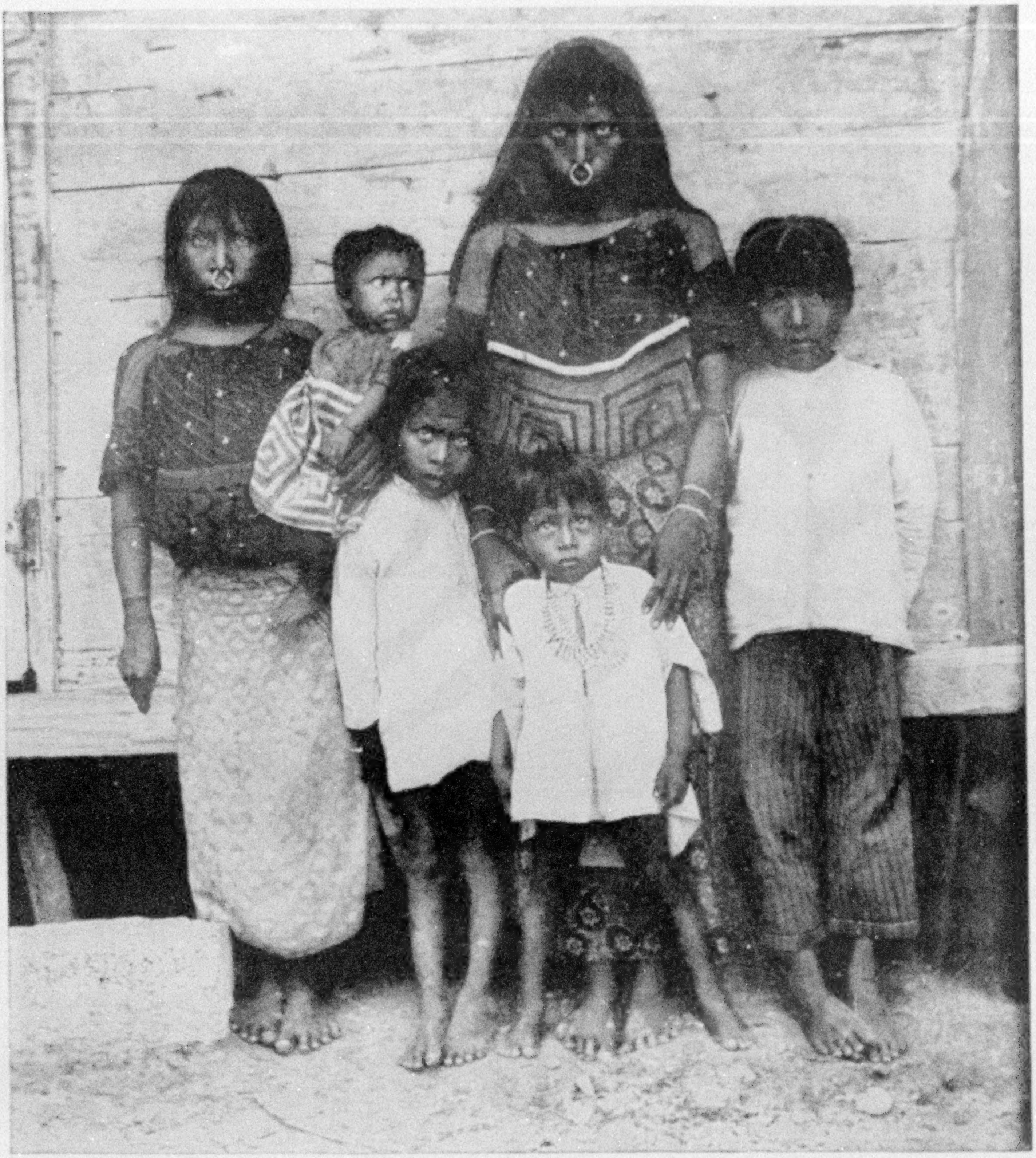


Photo by H. Pittier

SAN BLAS WOMEN AND CHILDREN, PANAMA: EVEN THE SMALL BABY GIRL HAS HER NOSE-RING DECORATION (SEE PAGE 657)

and also by the tradition of a long series of wrongs at the hands of the hated Spaniards.

So they feel that isolation is their best policy, and it would not be safe for anybody to penetrate into their forests without a strong escort and continual watchfulness. Many instances of murders, some confirmed and others only suspected, are on record, and even the natives of the San Blas coast are not a little afraid of their brothers of the mountains.

Of late, however, conditions seem to have bettered, owing to a more frequent intercourse with the surrounding settlements. A negro of La Palma, at the mouth of the Tuyra River, told me of his crossing, some time ago, from the latter place to Chepo, through the Chu-

cunaque and Bayano territories, gathering rubber as he went along with his party. At the headwaters of the Cañaza River he and his companions were held up by the "bravos," who contented themselves with taking away the rubber and part of the equipment, and then let their prisoners go with the warning not to come again.

The narrative of that expedition was supplemented by the reflection of an old man among the hearers that 20 years ago none of the party would have come out alive.

Among the San Blas Indians, who are at a far higher level of civilization, the exclusion of aliens is the result of well-founded political reasons. Their respected traditions are a long record of proud independence; they have maintained the purity of their race and enjoyed freely for hundreds of years every inch of their territory. They feel that the day the negro or the white man acquires a foothold in their midst these privileges will become a thing of the past. This is why, without undue hostility to strangers, they discourage their incursions.

Photo by H. Pittier

SAN BLAS WOMAN IN DAILY ATTIRE

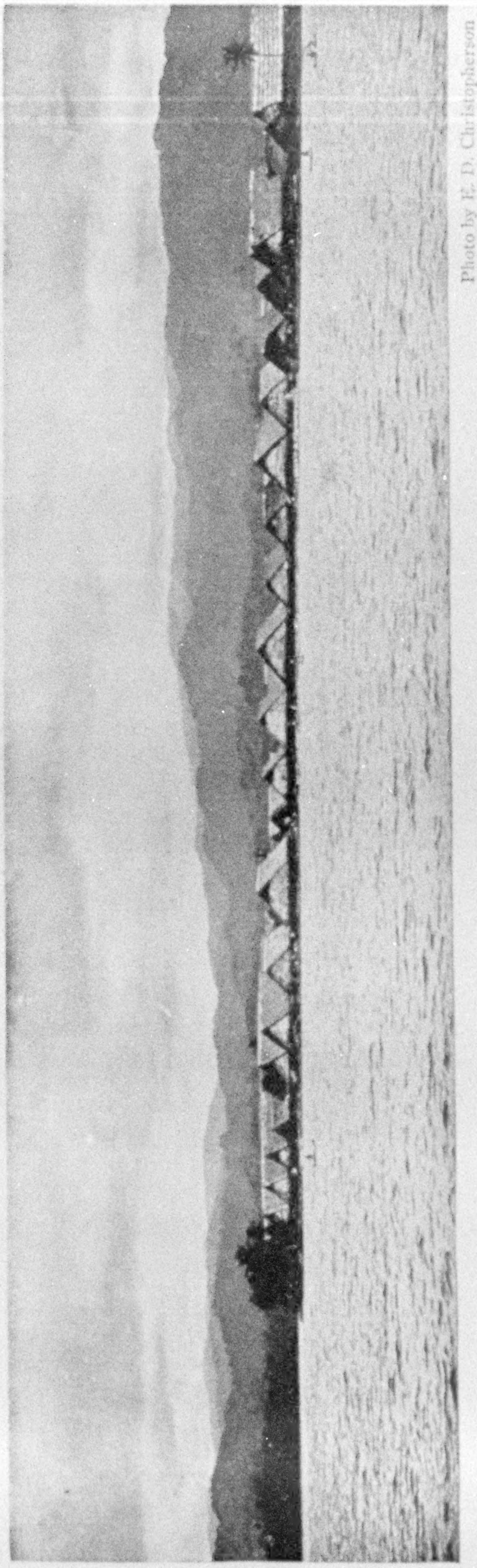
Their means of persuasion are adjusted to the importance of the intruder. They do not hesitate to shoot at any negro of the near-by settlements poaching on their cocoanuts or other products; the trader or any occasional visitor is very seldom allowed to stay ashore at night; the adventurers who try to go prospecting into Indian territory are invariably caught and shipped back to the next Panamanian port.

To the war vessel anchoring close to their coast they send a polite request to leave, and when a high official of the Isthmian Canal Commission asked to buy the sand of Caledonia Bay, to be used in the building of the Gatun locks, he was courteously refused, with the following reply from the old chief: "He who made this sand made it for the Cuna-Cuna who live no longer, for those who are here today, and also for the ones to come. So it is not ours only and we could not sell it."

To judge by the density of the population in the few villages visited by the writer, the San Blas Cunas, who also call themselves Tule, aggregate eight to ten thousand on the stretch of coast between Punta Escribanos and Cape Tiburon. Excepting Bocas del Toro, no other part of the Panamanian littoral is so densely populated, and there is no more orderly community in the whole Republic.

It is a great mistake to consider these Indians as mere savages. At least one man in every ten has traveled extensively as a sailor and has seen more of the world than the average Panamanian.

Photo by E. D. Christopherson



THE VILLAGE OF PLAYON GRANDE, ON THE SAN BLAS COAST, 85 MILES EAST OF THE PANAMA CANAL

The houses are about 150 x 50 feet and each shelters 16 to 20 families (see page 657)

Many have come to the United States or to Nova Scotia as children and have gone back grown men, with a relatively high degree of education. English is generally spoken along the coast, even to a larger extent than Spanish. The commodities of San Blas life are an incongruous mixture of native products and imported goods.

Primitive ways are perpetuated by the women, who have not been allowed as yet to have even a glimpse of the outer world and are, although perhaps to a lesser degree than among the Guaymies, the drudges of all work. In justice to them it must be said here that the often-repeated assertion of their hideousness is as wrong as it would be to affirm that all American females are beauties. The remarkable facility with which the San Blas men return to their simple and secluded life after staying for years in a more civilized environment must be attributed largely to feminine influence.

Times, however, are fast changing. Elementary schools, open to little girls, have already been established at Nárgana, under the guidance of a Catholic priest, and it is apparent that woman will soon turn out to be the progressive element of the coast of San Blas, as she is in most communities of Central America.

Besides being excellent sailors and fishermen, the San Blas Indians excel in agricultural pursuits. The whole coast, as well as the numerous islands of Mandinga Bay and farther east, are lined with extensive cocoanut-palm groves, of a variety remarkable for the superior quality and shape of the nuts. Vast areas of the forests are covered with the native ivory-nut palm and the larger growth abounds in balata or bully-trees.

The last three products—cocoanuts, ivory-nuts, and balata—which are sold or bartered either to local merchants or to trading schooners plying between the coast and the United States or New Brunswick and Nova Scotia, are the main

Photo by H. Pittier

PHYSICALLY THE CHOCOES OF PANAMA ARE A FINE LOOKING AND HEALTHY RACE: CHIEF DON CARLOS AND HIS SON (SEE PAGES 657-659)

Photo by H. Pittier

CHIEF DON CARLOS' LADY, WHO, NOTWITHSTANDING HER AGE, HAS PRESERVED HER GOOD LOOKS

sources of wealth of these natives, among whom money is never scarce and poverty an unknown thing. The staple crops for local consumption are raised in small clearings scattered through the forests of the interior and reached by water from the coast; besides most of the usual fruits of tropical America, these include plantains, corn, rice, cassava, yams, and some cacao.

The land belongs undivided to the community, so that any encroachment is considered as a public damage. Annual crops are seldom produced several years in succession on the same piece of ground, but once this is cleared and tilled it belongs to the individual or family who have done the work, until it returns to the public domain through voluntary abandonment.

Any cacao, orange, or other fruit-tree planted by hand becomes an hereditary possession, transmitted through the female line. I was unable to ascertain the traditional laws regulating the ownership of the cocoanut-palm plantations, but was led to understand that it is the same that obtains for any kind of fruit-tree as well as for plantain groves.

They do not seem to have any religious system, but there are indications of their holding to the notion of a superior being, the author of all things and the embodiment of goodness, and also of a bad spirit, governing all evil, whom they fear and revere more than the former. Their *lele*, or sorcerers, are at the same time the medicine men and the representatives of that genius of evil—a sensible combination—since they are supposed to have the power to check the harm caused by the latter.

At the time of the blossoming of the fruit-trees, and when the yearly seeds

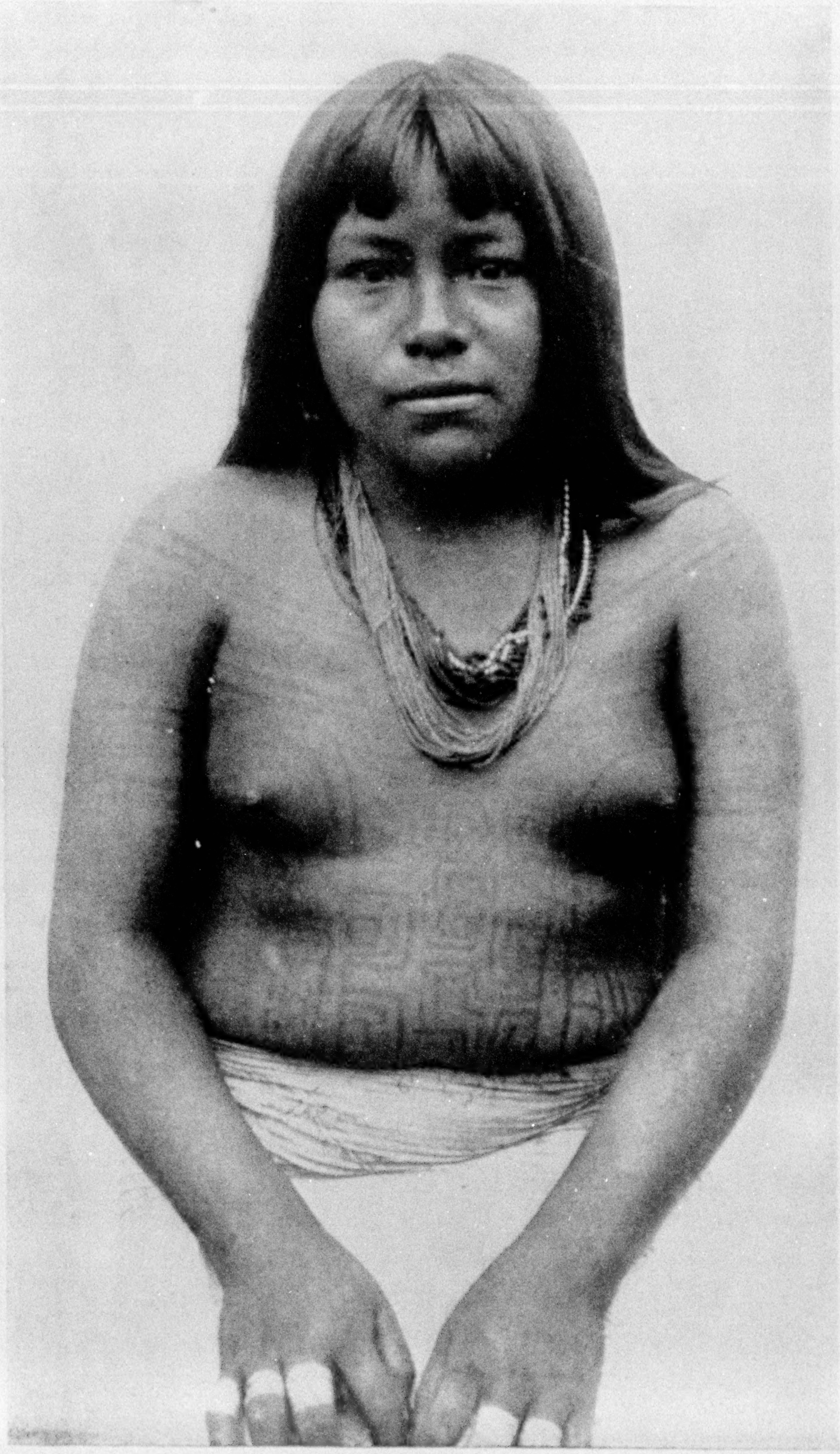


Photo by H. Pittier

THE CHOCO GIRLS ARE FAT AND FULL OF MISCHIEF: THE PAINTING OF THE BODY IS ABOUT AS EFFECTIVE AS A PEEK-A-BOO WAIST: PANAMA

This picture represents one of Don Carlos' daughters, who is very fond of finger-rings

XUM

Photo by H. Pittier

CHOCO INDIAN WOMEN OF THE SAMBU VALLEY IN THEIR SIMPLE, EVERY-DAY DRESSES: PANAMA

Note the peculiarity in the toes. With their feet they can pick up the smallest objects from the ground

are trusted to the earth, invocations in the form of recitals are sung by the men, and possibly offerings made, to propitiate the evil genius and call the blessing of the kindly God. I succeeded in obtaining a part of the invocation referring to the cacao crop. It seems to consist of an enumeration made to the *lele* of the several varieties of the cacao-pods, and of an appeal to a being personified by the ever-traveling sun.

The San Blas Indians are of small stature, with the body unusually long and broad-chested and the limbs short. The head is round and large and cheek bones very high, the nose long and often aquiline. The skin is dark reddish brown in the men, a few shades lighter in women. The hair is jet-black and as a rule cropped short, though a few of the girls wear it rather long, and the men have sometimes the whole mass of it cut straight, or bobbed, at the neck. Most women have remarkably fine white teeth.

Polygamy is allowed, but seldom practiced nowadays.

As a result of their frequent intercourse with the outside world, the San Blas men have adopted the ordinary garb of civilized people, reducing it to the simplicity required by the warm climate. Their native hats are peculiar in having the form much smaller than the head of the wearer, so that they are kept in place only by the stiff, short hairs acting as a sort of clinching spring.

Many men wear hanging from their ears large gold disks, often of the size and thickness of a $20 gold-piece. They are reticent as to the origin of the metal. In old times they probably obtained it by washing the sand of the rivers, several of which are said to be auriferous, but at present they very likely use for their personal adornment American and English treasure, having it modified to suit their taste by the native gold and silversmiths established in almost every village (see page 647).

The custom of face-painting is rapidly disappearing. At one of the villages some boys were seen wearing a single blue line along the ridge of their noses, and the *lele*, or medicine man, of Shiatinaka had evidently rouge (anatto dye) on his cheeks. These were the only instances of this kind of ornamentation, formerly of much more general vogue. The Chucunaque and Bayano Indians, who, their scant clouts excepted, dispense with clothes, are reported to paint their whole body jet black before starting on their hunting or fishing expeditions.

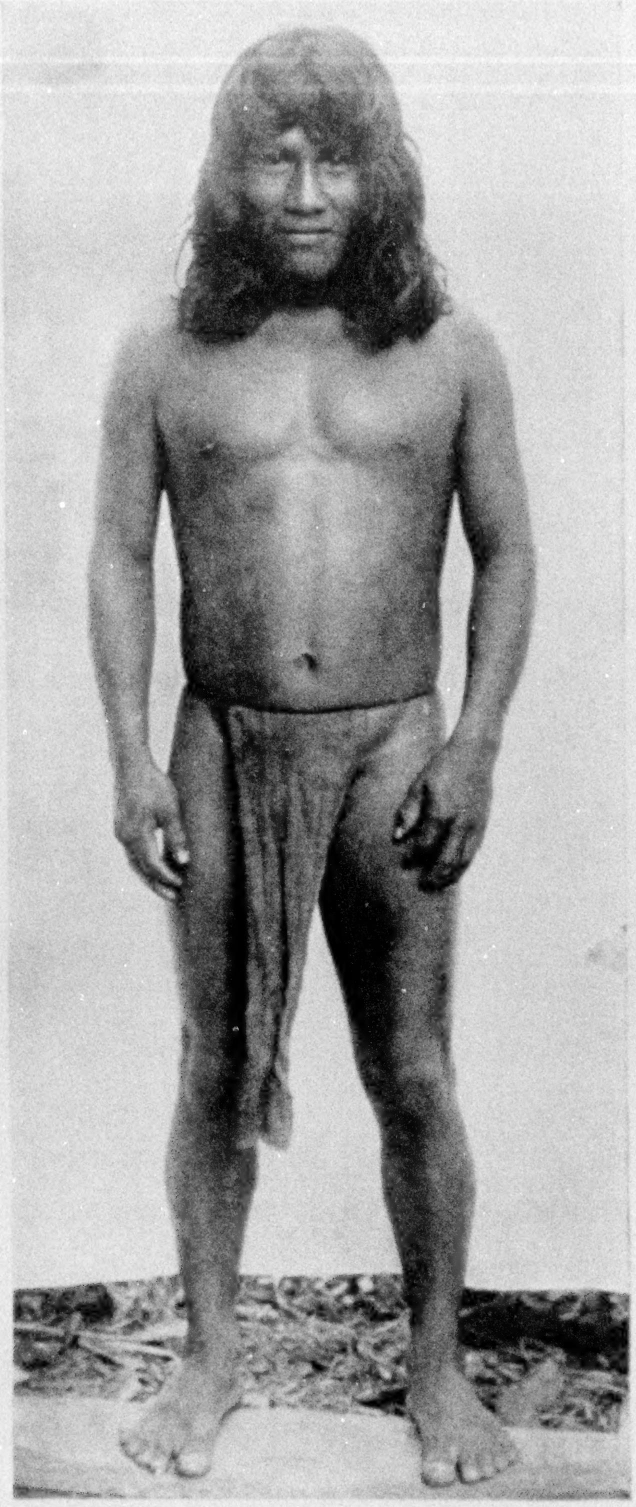


Photo by H. Pittier

A CHOCO INDIAN MAN OF THE SAMBU VALLEY IN EVERY-DAY DRESS

Photos by H. Pittier

A CHOCO INDIAN OF THE SAMBU VALLEY: REPUBLIC OF PANAMA

His hair is tied with a pearl-embroidered band. Note necklace of coins

For every-day wear, the apparel of the Cuna women consists of a short skirt, red or blue, extending from the hips to the knees. The upper part of the body is covered with a kind of loose blouse, the sleeves of which do not reach the elbow. Over these two garments there comes a second skirt, reaching from the waist to the ankles.

Of course, with reference to skirts, it must be understood that the word is used only for convenience sake, not meaning the rather complicated piece of civilized woman's raiment, but a single seamless piece of calico, not over four yards long, and rolled around the body.

The necks of the women are loaded with necklaces made of red, white, or blue beads, to which are added old Colombian silver coins. They also wear, occasionally, in their ears gold rings or disks, these latter like those of the men, and in their noses always another ring of the same metal, which is seen even on suckling baby girls, and is never removed at death (see page 648).

At Armila an opportunity offered itself to study the gala wearing apparel of the chieftain's wife, who was evidently the village belle. She had on some sort of short "sheath skirt" of white materials, and a long coat made of the appliqué work which is a peculiar product of the Cuna-Cuna handicraft. Her head was covered with a bright bandana handkerchief.

Besides her ear-disk and nose-ring, she wore on each arm a broad cuff at the wrist and a narrower band at the elbow; her legs were incased each in three tight bands, bound together by three vertical strings. Through the broad intervals the muscles were bulging abnormally, showing that the bands had been placed long ago and never removed. All these latter ornaments were made of white beads sown closely together on a piece of strong canvas.

There seems to be much variation as to the size of the Cuna houses, but they all have the naked beaten ground as floor and a high gable roof.

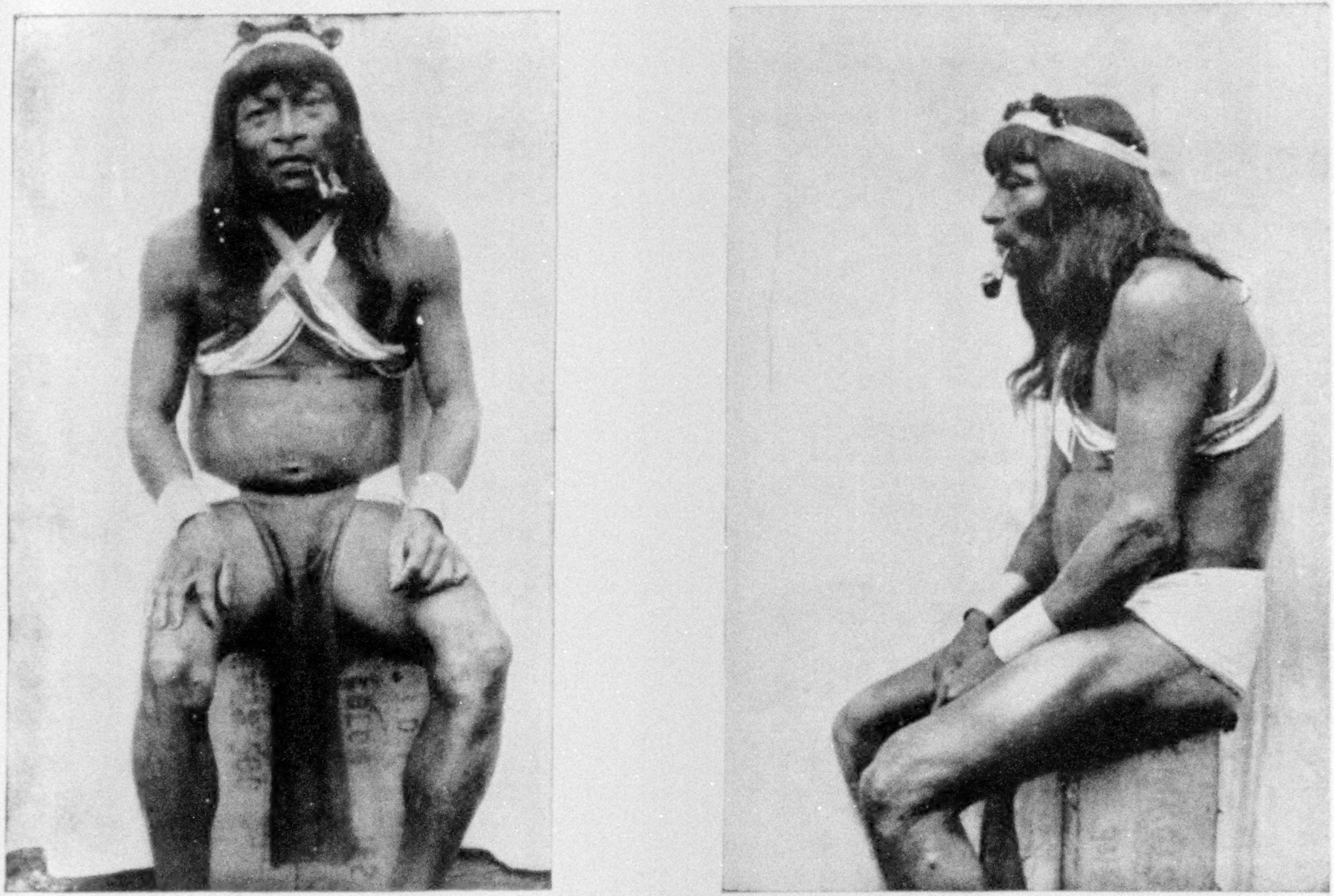
The two islands at Nárgana are literally covered with large dwellings, about 150 feet long by 50 feet broad, the long ridge of the palm-covered roof being 30 to 40 feet from the ground (see photo, page 650). Directly under this ridge there is a large alley, running between two ranges of high pillars, which support the middle part of the structure. On each side other upright posts divide the space into square compartments, each of which is occupied apparently by a separate family. There are only two low doors at each end of the building, and the side walls are made of sticks tied together, as are all parts of the building, with mountain vines.

These houses are packed so close together that there is no space left between them. Each shelters from 16 to 20 families, the exact parental relations of which would be an interesting demographic study.

THE CHOCOES

"*Les peuples heureux n'ont pas d'histoire!*" While the history of the Cuna-Cuna could be written, at least for the post-Columbian period, by putting together the brief accounts of the Spanish chroniclers, the quaint narratives of old writers like Wafer and Dampier, and oral tradition still current among the people of the tribe, we know almost nothing of the Chocoes They are seldom referred to in ancient records, and in modern times they have been visited by only one or two travelers, who have gathered but scant information. Our own visit among them was a short one, limited to the lower and middle part of the Sambu Valley, in the Panamanian section of southern Darien.

Never in our 25 years of tropical experience have we met with such a sun-loving, bright and trusting people, living nearest to nature and ignoring the most elementary wiles of so-called civilization. They are several hundred in number and their dwellings are scattered along the meandrous Sambu and its main reaches, always at short distance, but never near enough to each other to form real villages. Like their houses, their small plantations are close to the river, but mostly far enough to escape the eye of the casual passer-by.



Photos by H. Pittier

A CHOCO INDIAN OF THE SAMBU VALLEY, REPUBLIC OF PANAMA: HIS HEAD IS ADORNED WITH BRIGHT FLOWERS OF THE FOREST: NOTE THE BROAD SILVER CUFFS

Dugouts drawn up on the beach and a narrow trail breaking the reed wall at the edge of the bank are the only visible signs of human presence, except at the morning hours and near sunset, when a crowd of women and children will be seen playing in the water, and the men, armed with their bows and long harpooned arrows, scrutinizing the deeper places for fish or looking for iguanas and crabs hidden in the holes of the banks.

Physically the Chocoes are a fine and healthy race. They are tall, as compared with the Cuna-Cuna, well proportioned, and with a graceful bearing. The men have wiry limbs and faces that are at once kind and energetic, while as a rule the girls are plump, fat, and full of mischief. The grown women preserve their good looks and attractiveness much longer than is generally the case in primitive peoples, in which their sex bears the heaviest share of every day's work (see photos, pp. 652, 653).

Both males and females have unusually fine white teeth, which they sometimes dye black by chewing the shoots of one of the numerous wild peppers (*Piper* sp.) growing in the forests. The skin is of a rich olive-brown color and, as usual, a little lighter in women and children. Though all go almost naked, they look fairer than the San Blas Cunas, and some of the women would compare advantageously in this respect with certain Mediterranean types of the white race.

The hair is left by all to grow to its natural length, except in a few cases, in which the men have it cropped at the neck. It is coarse and not jet black, as reported of most Indians, but with a reddish hue, which is better noticed when the sun is playing through the thick mass.

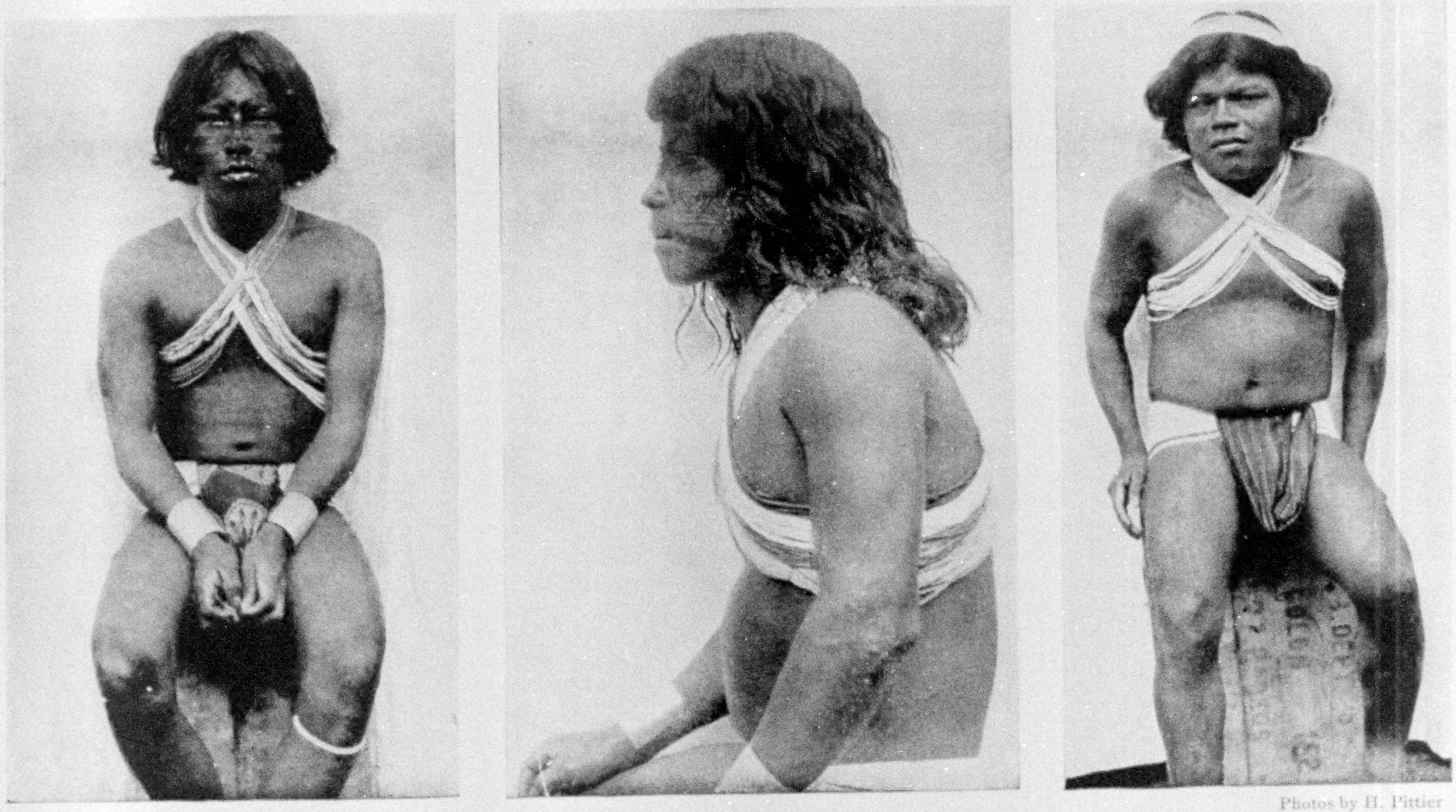
In young children it decidedly turns at times to a blond color, the only difference from the Caucasian hair being the pronounced coarseness of the former. As there are no white people living within a radius of 50 miles, but only negroes, mulattoes, and zambos, this peculiarity cannot be explained by miscegenation and may therefore be considered as a racial feature of the Choco tribe.

In men the every-day dress consists of a scanty clout, made of a strip of red calico about one foot broad and five feet long. This clout is passed in front and back of the body over a string tied around the hips, the forward extremity being left longer and flowing like an apron. On feast days the string is replaced by a broad band of white beads. Around the neck and chest they wear thick cords of the same beads and on their wrists broad silver cuffs (see photo, page 658). Hats are not used; the hair is usually tied with a red ribbon and often adorned with the bright flowers of the forest.

The female outfit is not less simple, consisting of a piece of calico less than three feet wide and about nine feet long, wrapped around the lower part of the body and reaching a little below the knees. This is all, except that the neck is more or less loaded with beads or silver coins. But for this the women display less coquetry than the men, which may be because they feel sufficiently adorned with their mere natural charms. Fondness for cheap rings is, however, common to both sexes, and little children often wear earrings or pendants.

The scantiness of the clothing is remedied very effectually by face and body painting, in which black and red colors are used, the first exclusively for daily wear. At times men and women are painted black from the waist down; at other times it is the whole body or only the hands and feet, etc., all according to the day's fashion, as was explained by one of our guides. For feast days the paintings are an elaborate and artistic affair, consisting of elegantly drawn lines and patterns—red and black or simply black—which clothe the body as effectively as any costly dress.

From the above one might conclude that cleanliness and modesty are not the rule among the Chocoes. As a matter of fact, the first thing they do in the morning is to jump into the near-by river, and these ablutions are repeated several times in the course of the day.



Photos by H. Pittier

CHOCO INDIANS OF THE SAMBU VALLEY: REPUBLIC OF PANAMA

The fellow at the left has horizontal lines across the face, a pair of silver cuffs, and a string of beads on his left leg; the one at the right is unusually plump and fat. Note face-painting

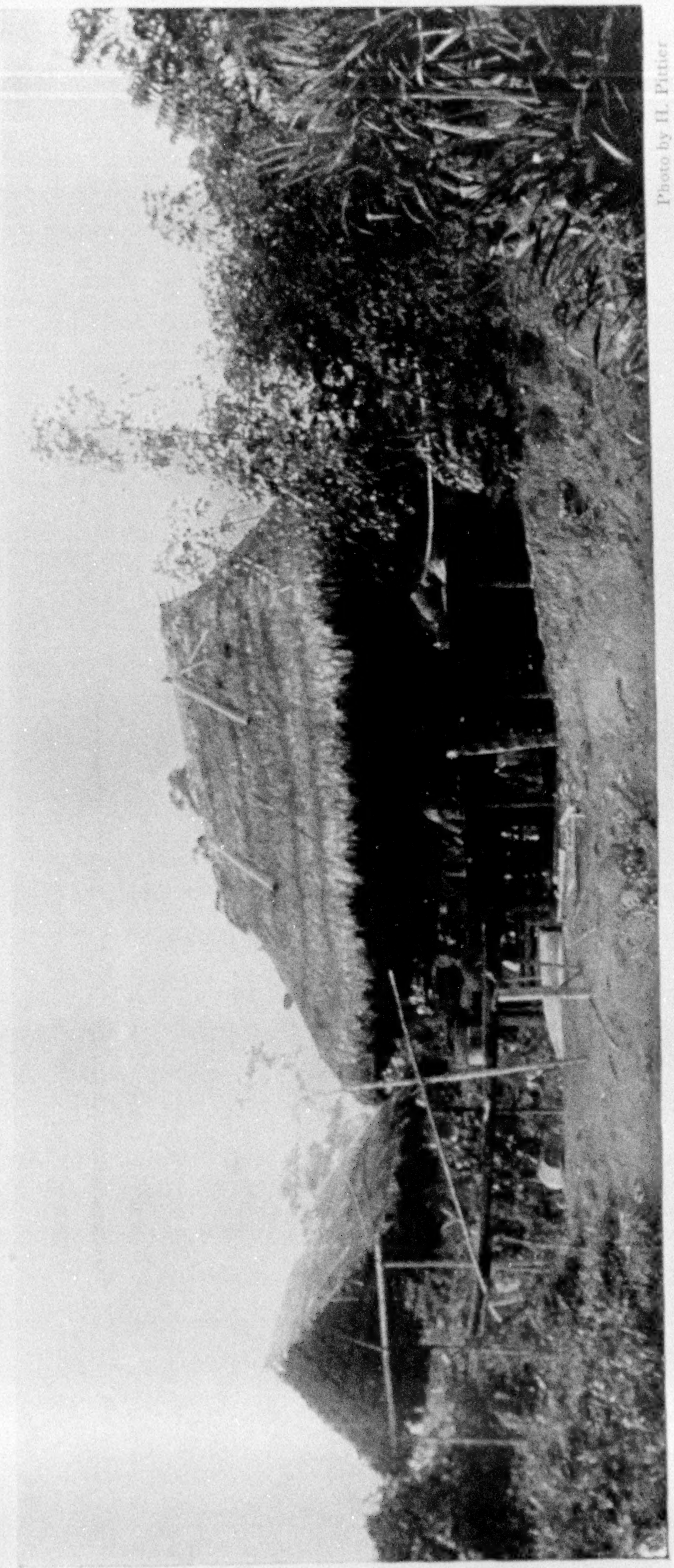


Photo by H. Pittier

THE HOUSES OF THE CHOCOES ARE BUILT HIGH UP ON THE RIVER BANK AND ARE SELDOM VISIBLE TO THE PASSING CANOES

The kitchen utensils are always thoroughly washed before using, and, contrary to our former experience, their simple dishes, prepared mostly in our presence, looked almost always inviting. During our stay among these good people nothing was noticed that would hurt the most delicate sense of decency.

The Chocoes seem to be exclusively monogamist and both parents surround their babies with tender care, being mindful, however, to prepare them early for the hard and struggling life ahead of them. Small bows and arrows, dexterously handled by tiny hands, are the favorite toys of the boys, while the girls spend more time in the water playing with miniature dugouts, washing, and swimming. The only dolls seen among them were imported ones, and they seemed to be as much in favor among grown women as among children. These latter go naked until they are about 5 years old, when the girls receive a large handkerchief to be used as a "paruma," or skirt, and the boys a strip of some old maternal dress for a "antia," or clout.

The houses of the Chocoes are built on a better plan, as far as hygiene and comfort are concerned, than those of either the Cuna-Cuna or the Guaymies. Placed high up on the river bank and seldom visible to the passing canoes, their structure is almost

uniform, although the dimensions vary. That of one of the leading men of the Sambu Valley is rectangular and measures about 50 by 30 feet, the longest side facing the river.

The floor is raised eight feet from the ground and supported on each long side by a row of four palm posts, which extend through it and bear the weight of the roof. Trunks of the Iriartea palm, split open and flattened, form the flooring. The roof is palm-thatched and with four sheds, two of which correspond to the long sides of the houses and join at the top in a gable 12 feet long, while the two remaining ones at the ends of the building are triangular. There are no walls (see page 661).

Access to the floor is by means of a notched pole, which is turned over when the dogs are not wanted around, or also to indicate the absence of the family. The kitchen hearth is built at the corner least exposed to the prevailing wind, and consists of a square frame filled with clay, with a few loose stones on which to set the pots. Such a house has an ideal ventilation and affords at the same time a good shelter against rain and the excessive dampness of the soil.

At night the floor, which is kept scrupulously clean, is turned into a family bed. Long sticks are inserted between the slats and made to reach the ground below, and on these mosquito bars are hung. Bark mats form the bedding. The largest space is the parental nook, occupied also by the babies, while the elder girls and boys each have their own sleeping corner.

The Chocoes are very industrious. During the dry spells their life, of course, is an out-of-door one, planting and watching their crops, hunting, fishing, and canoeing. But when the heavy rains come they stay at home, weaving baskets of all kinds—a work in which the women are proficient—making ropes and hammocks, carving dishes, mortars, stools, and other objects out of tree trunks.

And right behind the house is the great forest, never yet violated by the civilized man's ax. There the giant monkey-pot tree raises its crown 150 feet above the ground, extending its protecting branches over many other portly trees unknown today, but which may sooner or later find their way to the mills and shops of civilized nations. Under their shadowy tops high palms with elegant stems, ariza-trees whose trunks are hidden under hundreds of scarlet flowers, vines whose enlacing stems extend from branch to branch, and epiphytic plants that fill every available nook, all compete in luxuriance and beauty.

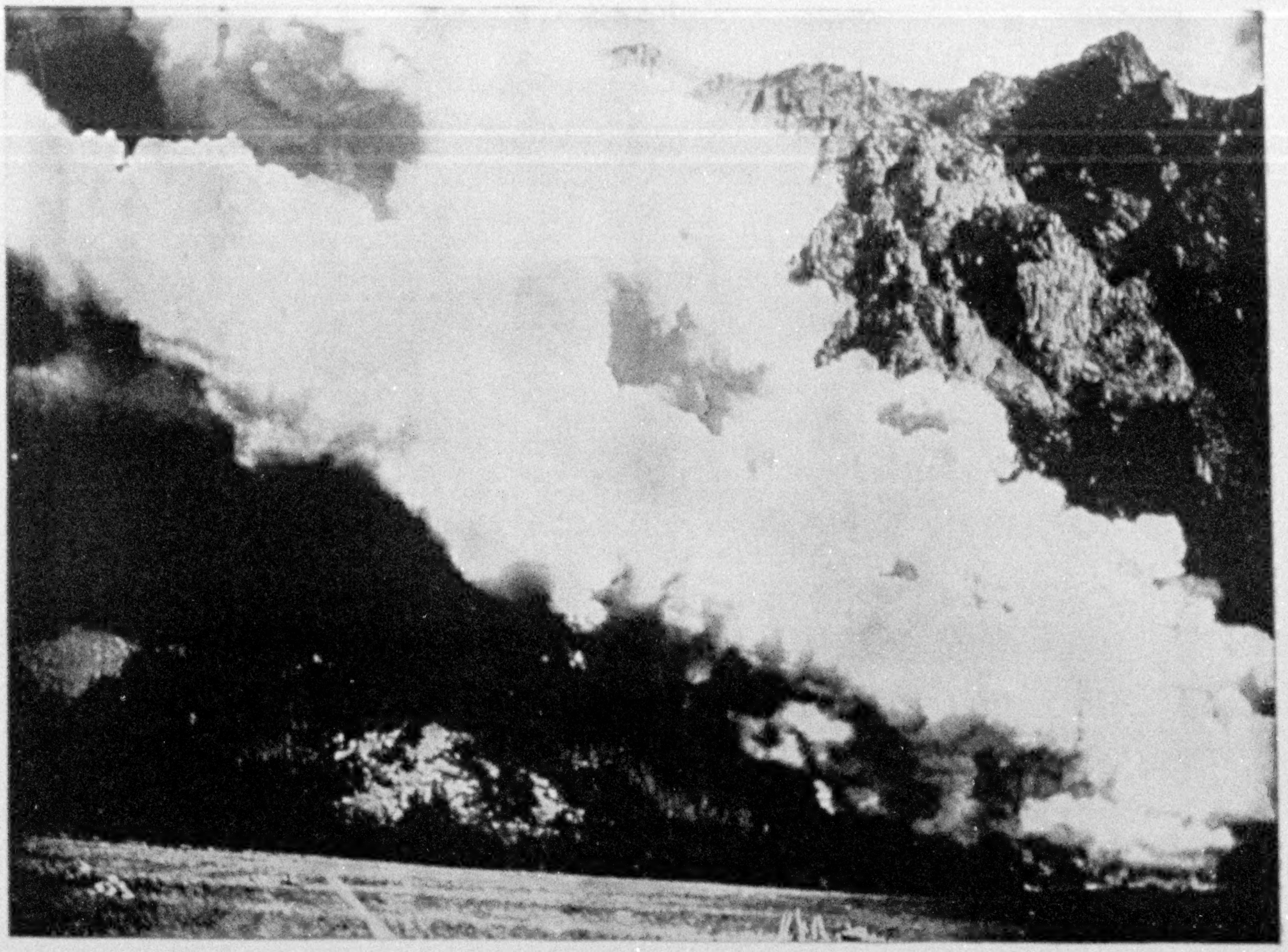
THE FIGHT AGAINST FOREST FIRES

By Henry S. Graves
Chief of U. S. Forest Service

THE first step necessary in establishing the practice of forestry is the prevention of forest fires. Until recently there was no organized effort in the United States to prevent forest fires. In many sections they were regarded as a matter of course, and almost no consideration was given to their consequences.

Forest fires are by no means confined to recent periods, although the greatest damage has taken place since the development of the country began. There are relatively few forest regions of the country where some traces of forest fires cannot be found. Scars at the base of trees, the presence of charred wood, peculiarities in the character, composition, and form of the forest indicate to the forester that there has been fire of greater or less severity.

It is probable that nearly the entire forest area of the country has been burned over by fire at some time or other, although in many places the fires may have merely burned over the ground



A FOREST FIRE SWEEPING UP A SLOPE IN THE ROCKY MOUNTAINS

without serious damage to the largest trees.

The ancient fires were started by lightning and by Indians. Traces of injuries to the big trees in California are found dating back over 1,000 years.

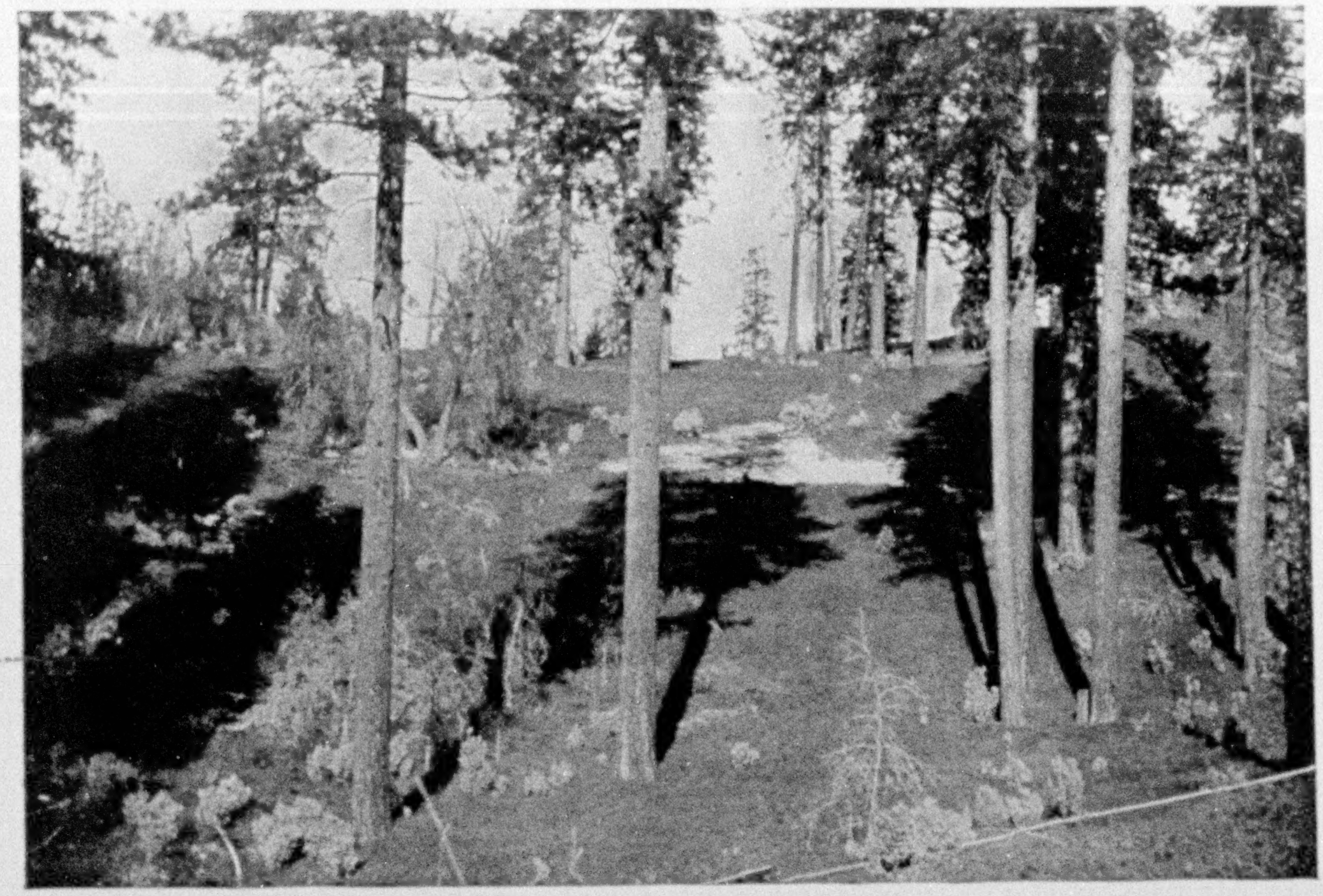
It is a common belief that the virgin forest represents the maximum product of the soil. This is because there are present many large and old trees. Most virgin forests, however, in this country have been thinned by repeated fires, and the present product does not by any means represent what might be standing on the ground if there had not been any such injury.

Many illustrations of this are found in the mountains of the West, where past fires have left the forests open and broken and with a greatly depleted yield of timber (see photo, page 664). As soon as these forests were put under protection by the national government an immense amount of young growth began to spring up in the open stands, indicating possibilities for production of timber entirely beyond anything represented by the virgin stands.

With the opening up of the forest regions by settlement, railroad construction, lumbering, and other development, forest fires began to increase at an enormous rate. Lumbering was almost invariably followed by fire, and many of the most disastrous conflagrations have resulted from fires which gained their first headway in the dry tops left after logging.

In every forest there is a certain amount of inflammable material, consisting of dry leaves, decayed vegetable mold, branches, twigs, cones, dry grass, and other litter. The most common type of fire is that which runs over the surface of the ground, consuming this material. This is called a surface fire. Sometimes a fire may start when only the upper layer of leaves is dry, and may run slowly through the woods without serious injury. More commonly they occur in very dry weather and burn all the ground cover, destroying all small trees and either killing or injuring the larger trees.

Repeated fires of this character rapidly reduce the density of a forest, for some



THE EFFECT OF FOREST FIRES IN MAKING A FOREST OPEN AND BROKEN

A forest of yellow pine in California. Every fire kills some trees, and, if continued, finally destroys the forest. This forest has been opened up and has only a relatively small yield of timber as a direct result of past repeated fires.

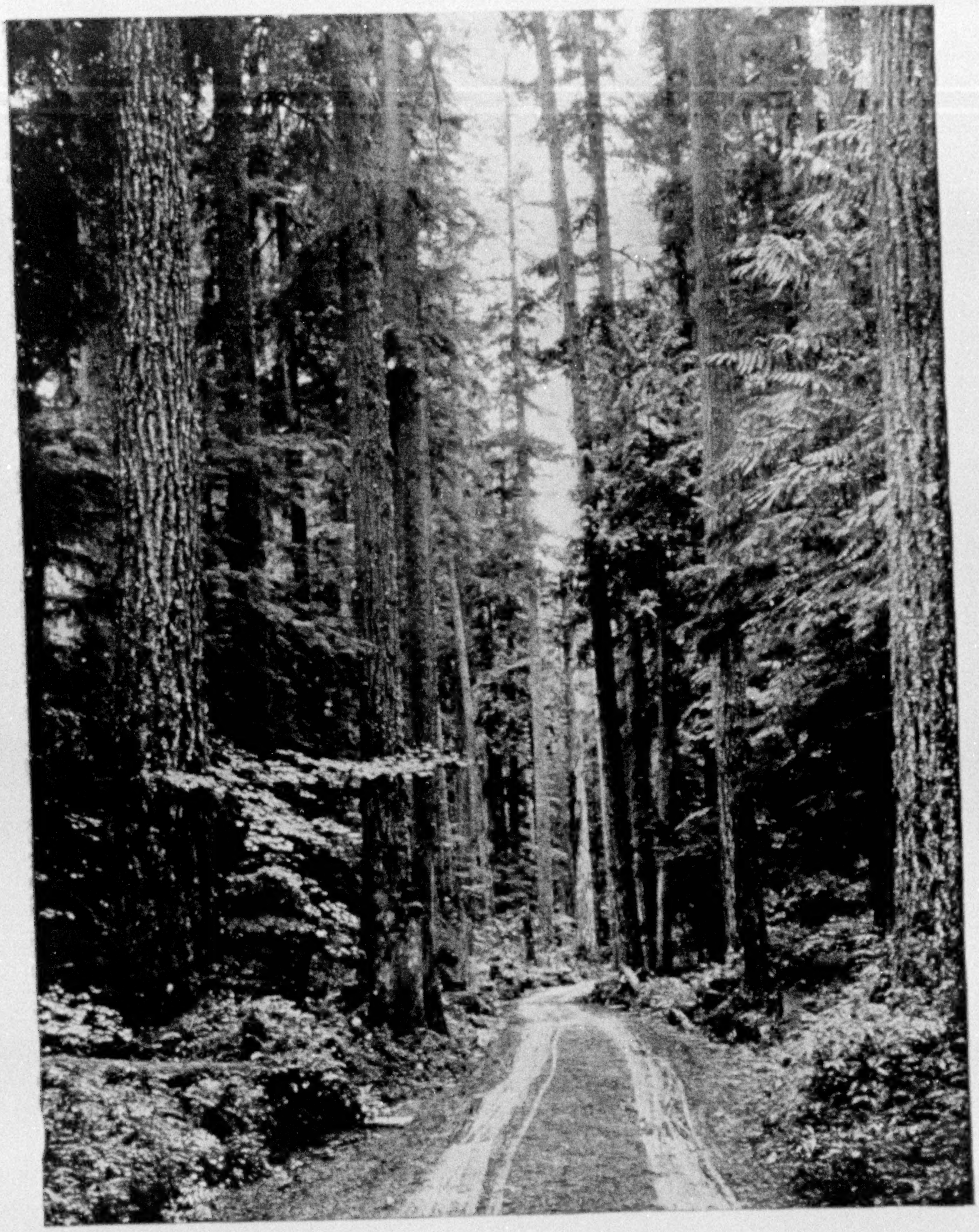
trees die as the result of each fire, and, as the young growth is also killed, the forest becomes more and more open and broken. This explains why in many remote forests, where there has never been any cutting at all, the trees stand far apart and the yield in valuable material is small. Frequently in a virgin forest the yield is not over one-fifth to one-tenth of what it would have been if fires had not occurred.

In some regions, particularly in the North, there is in the forest a deep layer of decayed vegetable mold, or humus, frequently one to three feet deep. When this becomes thoroughly dry a fire burns slowly and persistently through it, killing the roots of the trees. These are called ground fires and are exceedingly difficult to extinguish. They have been known to smoulder for long periods under the snow (see photo, page 667).

The most destructive fires are those which not only burn over the ground, but sweep up into the tops and actually consume the crowns of the trees. These are called crown fires. They are common in forests composed of coniferous trees, as the forests of the East and the Lake States and the coniferous forests of the far West. The crown fire usually starts as a surface fire; but, under the influence of a strong wind or when burning in a mass of old, dry tops or other débris, the flames are carried into the crowns. With conditions just right the green crowns are ignited, and a conflagration develops which sweeps everything before it.

TERRIFIC FIRES WHICH KILLED HUNDREDS OF PEOPLE

There have been a number of great fires which have attained historic importance. One of these occurred in New Brunswick, in the fall of 1825, on the Miramichi River, during a season of great drought. Many fires of greater or



A TYPICAL VIRGIN FOREST IN WASHINGTON UNTOUCHED BY FIRE

The principal tree is Douglas fir, three to eight feet in diameter and 200 to 250 feet high. Forest fires have done but little serious damage. Trees of all ages grow mingled together.

less proportions were burning throughout that region, and it is probable that but little effort was made to extinguish them. Early in the afternoon of October 7 the various smaller fires began to sweep together and formed a single fire of enormous proportions.

Within nine hours the fire had burned over a strip of forest 80 miles long and 25 miles wide, destroying every living thing in its path. One hundred and sixty persons perished and nearly 1,000 head of stock. Five hundred and ninety buildings were burned and a number of towns were destroyed, including Newcastle, Chatham, and Douglastown. It is

SLASH LEFT AFTER LOGGING: THE GREATEST MENACE FROM FIRE

In all timber sales on the national forests this débris is destroyed

related that even great quantities of fish in the river were killed by the heat of the fire.

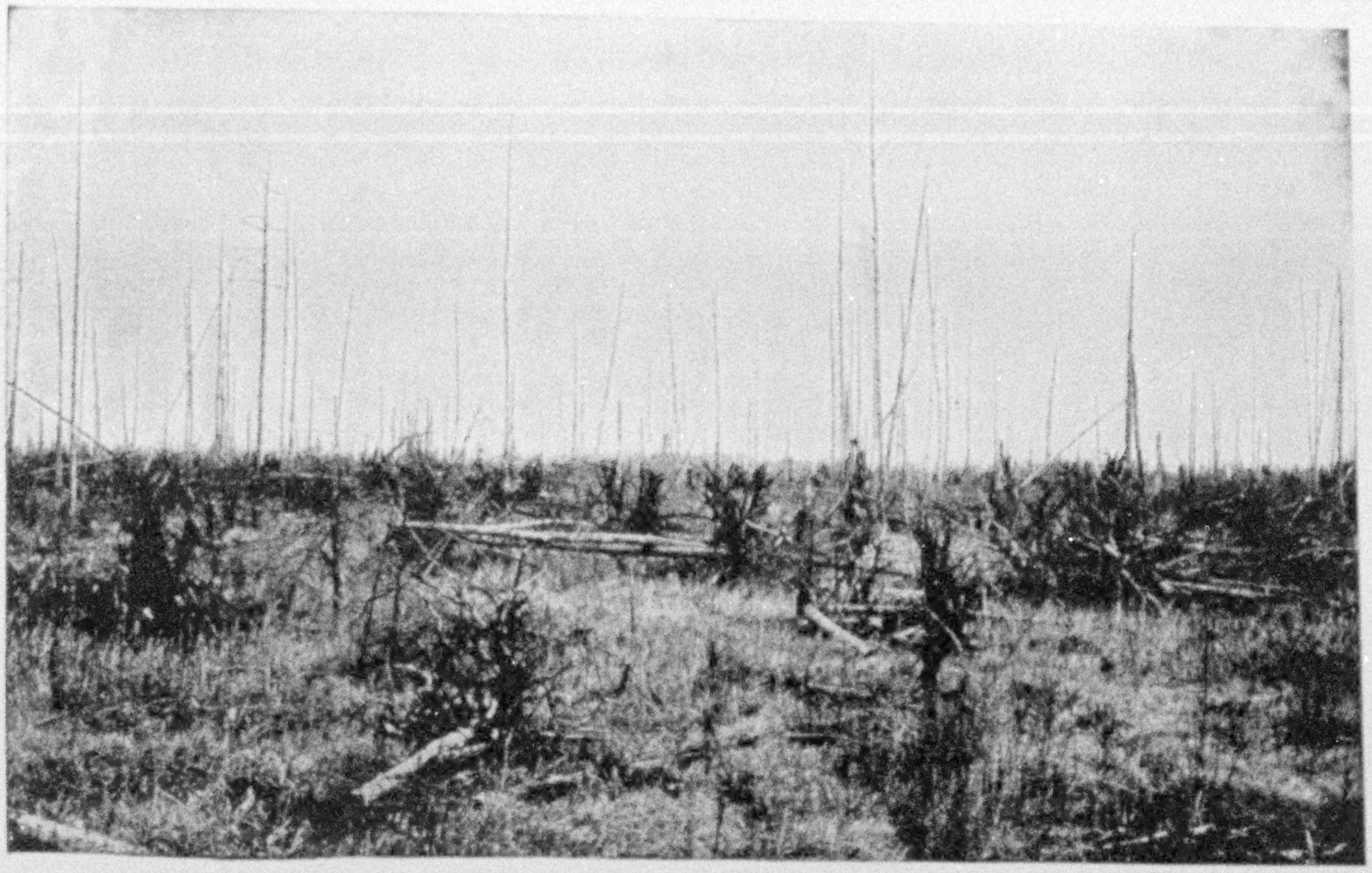
Another historic fire was that which occurred in Wisconsin in the fall of 1871. A single fire swept over an area of more than 2,000 square miles. It destroyed the town of Peshtigo, and between 1,200 and 1,500 persons perished. That same year the damage by fire elsewhere in the country was enormous.

Still another fire, which is still remembered by many persons, was that which destroyed the town of Hinckley, Minnesota, in the fall of 1894. As in other cases of great fires, there was a season of exceptional drought. The woods became very dry, especially on those areas which had been recently cut over by the lumbermen, where a great mass of tops and other débris was left upon the ground. Many fires were constantly starting during that fall, but there was no effective effort to extinguish them. Forest fires were so common that there was no special fear of possible danger until it was too late to meet the situation.

As often happens when there are many fires burning under these conditions and a high wind springs up, the different small fires were suddenly merged together, and a great crown fire resulted which swept over the town of Hinckley and six other towns, entirely destroying them, killing 500 persons, and making over 2,000 more entirely destitute. The estimated loss in property by this fire was more than $25,000,000.

THE GREAT CATASTROPHE OF 1910

The most recent great disaster from forest fires occurred in the Pacific Northwest in 1910. That year was the driest ever known in the West, particularly in northern Idaho and northwestern Montana. Practically no rain fell from early spring until October. The



AFTER A FOREST FIRE IN WISCONSIN

This forest of larch was destroyed by a ground fire burning in the deep vegetable mould. The roots were killed and the trees uprooted by the wind

forest became dry as tinder and there were fires springing up here and there throughout the forests. Many fires were started as early as May and by the middle of June the situation became serious.

The national forests in this section are in many cases still without roads, trails, and other means of communication, so that although the forests were equipped with a force of patrolmen many fires started at remote points which it was impossible to reach until the fires had gained considerable proportions and were very difficult to extinguish.

On July 23 a severe electric storm, practically without rain, passed over the northern Rocky Mountains, setting a large number of fires. The Cœur d'Alene Mountains in particular suffered from these fires. In three days the forest rangers put out nine fires set by lightning in the Cœur d'Alene National Forest.

Five others from the same cause and same storm started in remote and inaccessible places which could not be reached until they assumed large proportions. From one cause or another, many other fires were set. Heroic measures were taken to extinguish them.

At one time 1,800 men, besides two companies of soldiers, were fighting fires in the Cœur d'Alene forest alone, and large crews were fighting fires in other parts of the northwestern forests. The men fought stubbornly, working day and night building trenches around the fires and gradually confining them to a small area.

All fires seemed to be under control, when on August 20 a terrific hurricane sprung up, sweeping all the separate fires together and making a gigantic wall of flame many miles long. Many of the fire fighters were directly in the path of the fire. Seventy-nine fire fighters were killed, and if it had not been for the skill and the nerve of the forest rangers in charge of the crews a very much larger number would have perished. As it was, about half of the number killed lost their lives because of their failure to obey the

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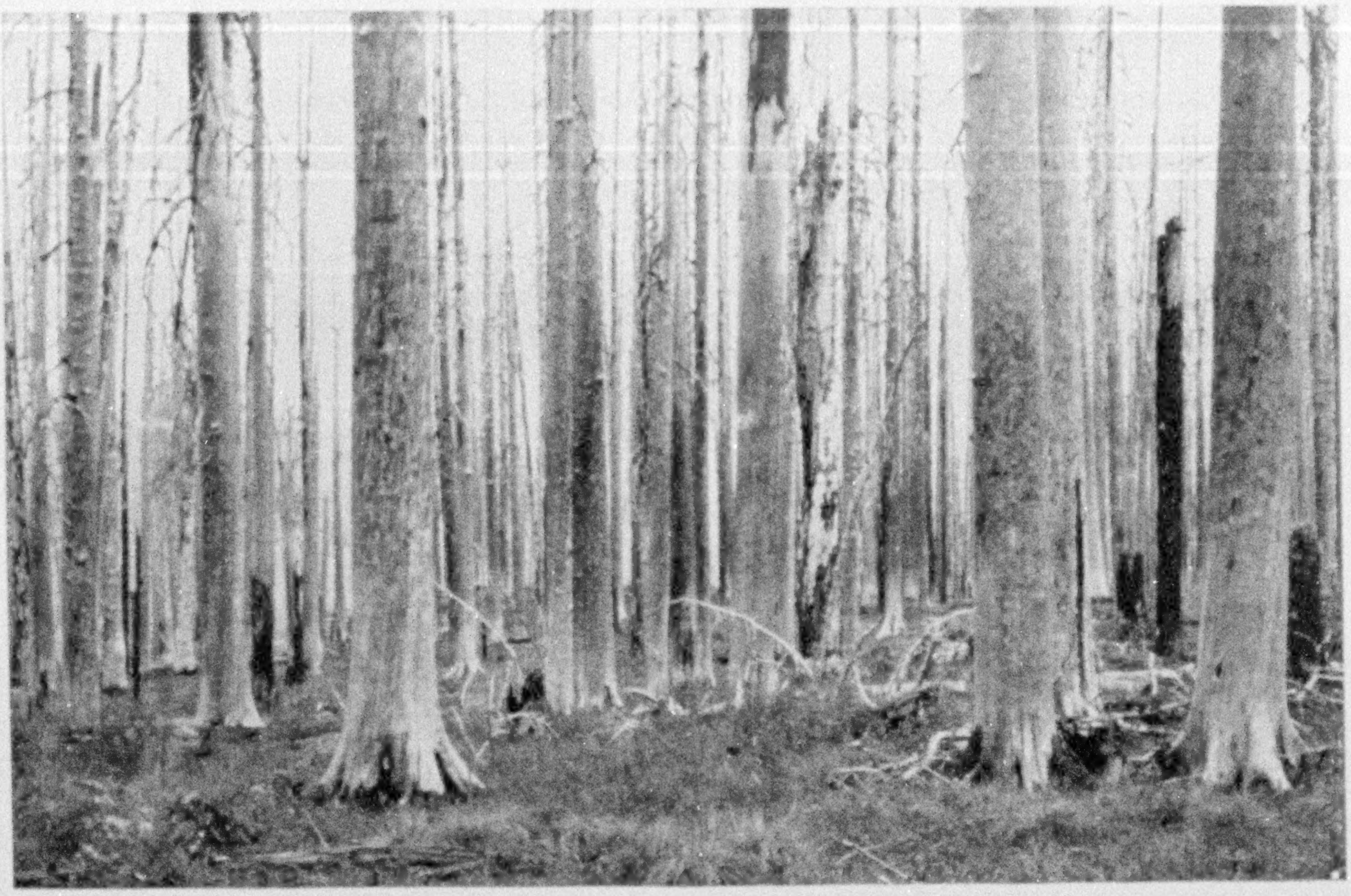


A FOREST OF NOBLE FIR IN WASHINGTON DESTROYED BY FIRE

This forest contained 20 to 40 thousand feet per acre of valuable timber

orders of the forest rangers in charge of the parties.

HEROISM OF FOREST RANGER PULASKI

Many instances of heroism occurred during that fire whose recounting would fill many pages. One case will serve as a typical illustration of the sterling qualities of the men making up the force of rangers protecting our national forest property.

Forest Ranger Pulaski was in charge of about 150 men, distributed over a distance of several miles along the divide between Big Creek of the Cœur d'Alene River and Big Creek of the St. Joe River. As the peril became imminent he brought together about 40 of his men who were in the danger zone and started with them down the mountain toward Wallace, Idaho, a distance of 10 miles. When about half way down the mountain he found that he was cut off by new fires.

His men became panic-stricken, but he assured them that he would still get them to a place of safety. Being thoroughly familiar with the region, he knew of two prospect tunnels near by, the shorter being about 50 feet and the longer about 100 feet in length. Not being certain whether he could reach the largest and safest, he put a wet gunny sack over his head and worked his way to the largest tunnel. Finding that it was safe, he rushed back to his men and hurried them to the tunnel, arriving just in time to get them inside before the fire reached them. At this time he had with him 42 men, all of whom he managed to get into the tunnel with the exception of one, who had fallen behind and was caught by the fire before he could catch up with his comrades.

The timbers supporting the tunnel caught fire, and Pulaski, standing guard at the mouth of the tunnel, managed to catch with his hat some water from a little stream that flowed from the bottom of the tunnel, which he kept dashing upon the burning timbers until he himself was so badly burned that he fell unconscious. Prior to losing consciousness he commanded his men to lie on their faces for protection.

Probably all of the men were uncon-

A TYPICAL SCENE OF DESOLATION AS THE RESULT OF FOREST FIRES: MINNESOTA

scious for a time, but finally one who had received less injuries than the others was able to crawl out of the tunnel after the fire had passed over them and drag himself into the town of Wallace to notify the forest office of the situation. This was about 3 o'clock in the morning.

A crew was immediately organized and sent to the tunnel. All of the men were saved with the exception of five, who had been smothered before relief came. Had not Pulaski known of the location of the tunnel and handled the situation with the skill and courage that he did, his entire crew would have perished.

ONE HUNDRED MILLION DOLLARS DESTROYED EVERY YEAR BY FOREST FIRES

During the same year there were many fires throughout other parts of the West, including California, Oregon, and Washington. These occurred both on private lands and on the public forests.

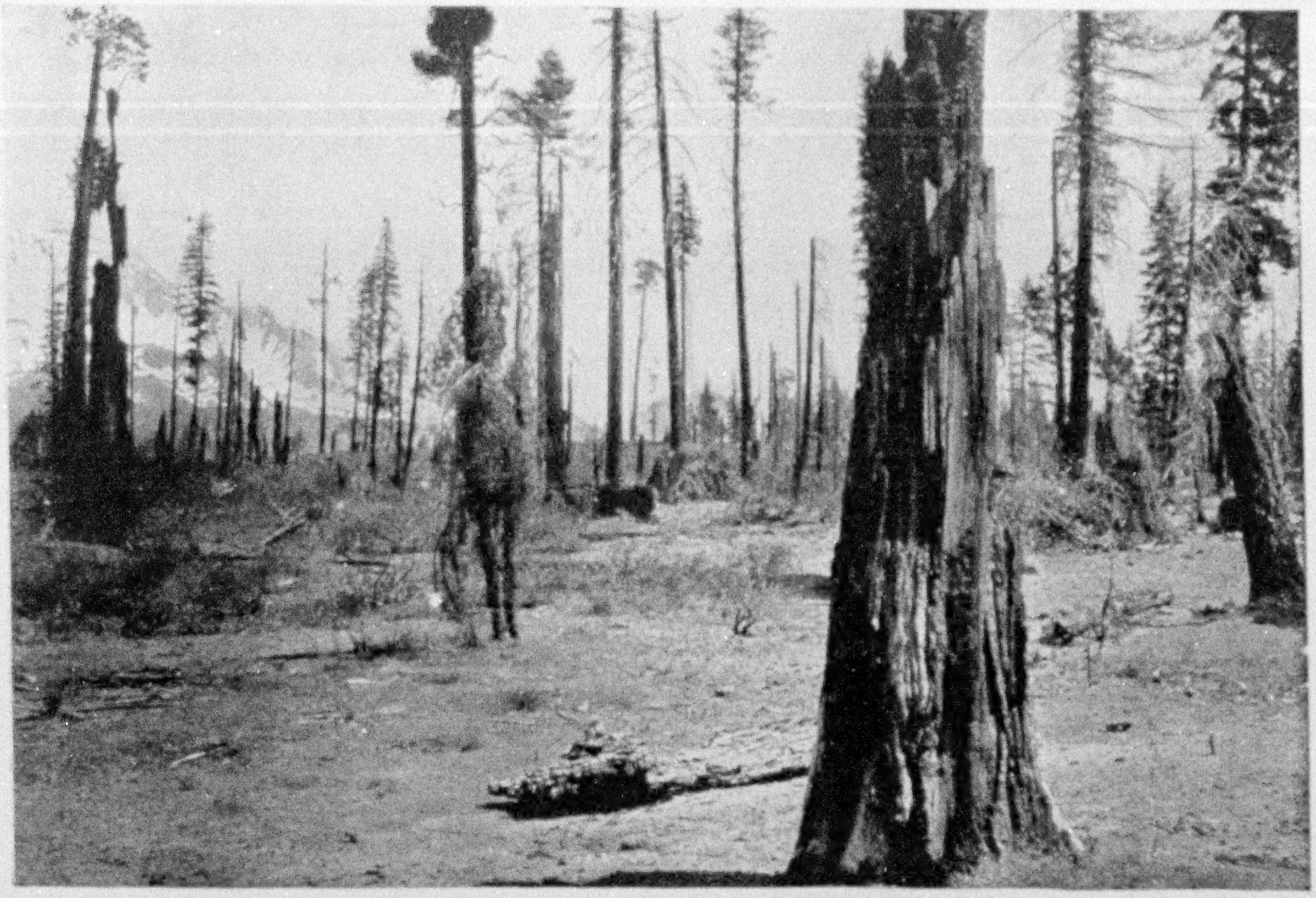
On the national forests alone there were over 5,000 fires. Most of these were extinguished by the organized force of rangers, the chief damage being done by a few fires which could not be controlled on account of lack of trails, telephone lines, and other improvements. The damage to the public forests alone amounted to over 14 million dollars in the destruction of timber, besides extensive damage to young growth.

If there had been no organized force of men to fight the fires, practically the entire forests in many regions would have been destroyed. It is certain that the damage would have reached 100 million dollars and perhaps twice that amount.

But the great loss by forest fires is not by any means confined to these great conflagrations. The scattered smaller fires destroy also a large amount of merchantable timber, but the very greatest damage, often overlooked, is in the killing of the immature and small trees and the prevention of new growth.

The indirect injury by forest fires is also enormous. The fire risk removes incentive to the practice of forestry by private owners. The rapid destruction of the forest by fires results in the short life of many industries, a reduction in land values, and after a time the actual depopulation of forest regions. Still another serious result of forest fires in

VAST DESTRUCTION BY FOREST FIRES; SAN FRANCISCO MOUNTAINS, ARIZONA



A FOREST AT THE FOOT OF MOUNT SHASTA, CALIFORNIA: THIS CONDITION IS THE RESULT OF REPEATED FIRES

mountain regions is the disturbance of the regularity of water flow and the erosion which under certain conditions causes great damage.

The total annual damage from forest fires, including the destruction of timber and other property, the destruction of young growth, the prevention of young growth, and all the indirect injurious effects, is difficult to estimate. It has been generally accepted that the damage to timber alone has amounted to at least 25 million dollars annually. The annual destruction of immature trees and young growth probably totals fully 20 million dollars, while the injury resulting from the actual prevention of reproduction is at least 60 million dollars more. This must be considered in connection with the drain on our forests for products actually used in the form of timber, poles, ties, mine props, fuel, etc.

It means but little to the layman to say that we use each year over 40 billion feet of lumber, or 23 billion cubic feet of all classes of wood, including fuel. Suffice it to say, that it requires 8 to 10 million acres of well-stocked forest, such as occurs in the East, to provide one year's supply.

FOREST FIRES CAN BE PREVENTED

When the reader realizes that the production of timber by growth is only about one-third the amount used (and in this statement no account is taken of the vast destruction by forest fires), he will appreciate how imperative it is that we stop the fires and also that we introduce forestry methods, in order that we may produce new supplies to meet the needs when the virgin stock is exhausted.

The old view, that forest fires are inevitable and that no system can be devised to prevent them, is obsolete. It has been clearly demonstrated within the last few years that by proper organization forest fires can be prevented. But if the forests are neglected forest fires cannot be prevented, any more than city fires can be prevented without an efficient and well-equipped fire department.

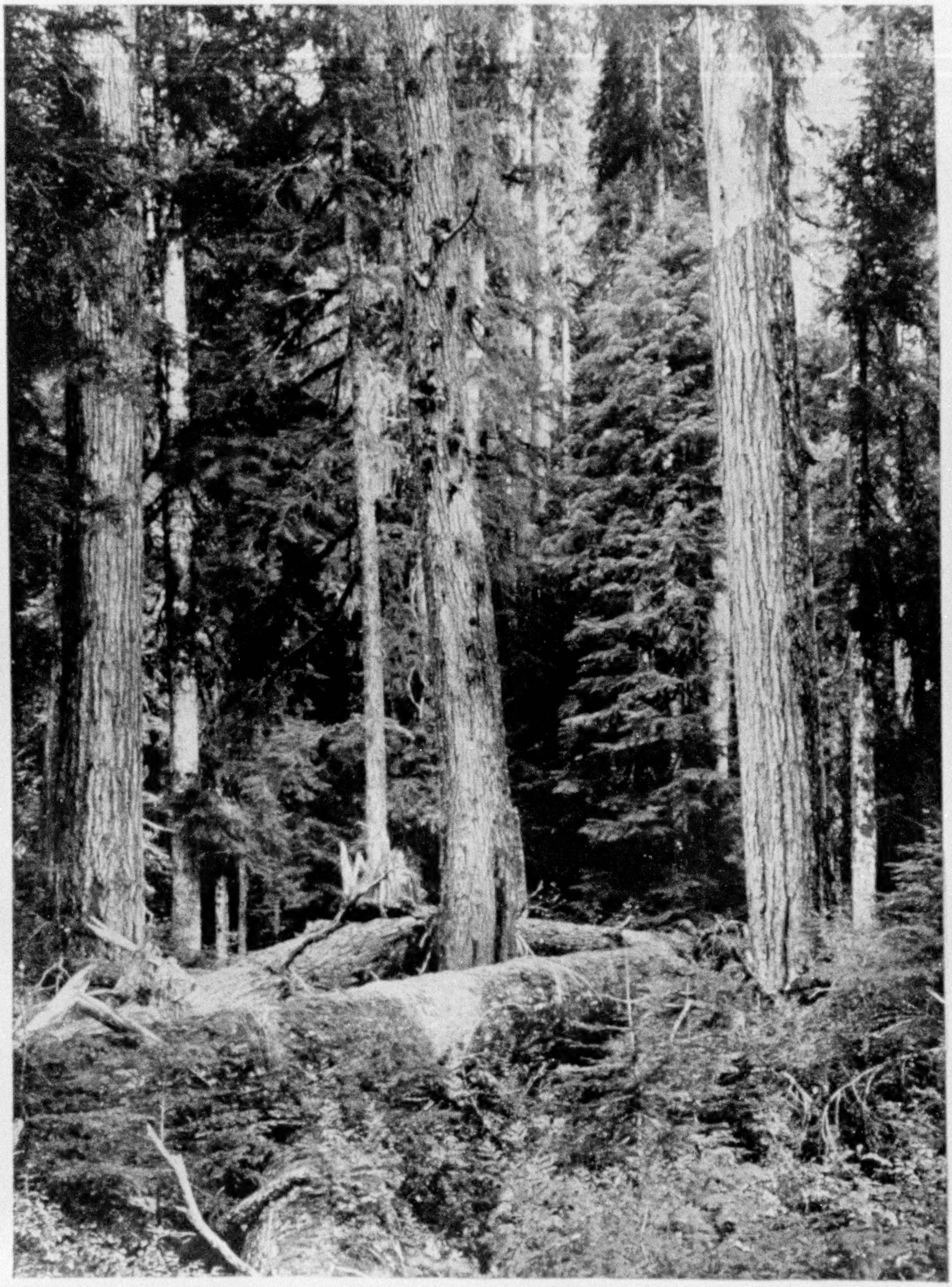
We have had great losses by forest fires because adequate steps have not

FALLEN DEAD TREES IN A LODGE-POLE FOREST IN MONTANA

This dead material makes dangerous fuel for fires, renders travel slow, and fire-fighting very difficult

been taken to prevent them. In many cases the laws are entirely inadequate. The chief trouble has been the unwillingness to spend the money necessary to do the work. There should be much more liberal appropriations for the protection of public forests and for promoting forestry among private owners, and private owners should take better care of their timbered and cut-over land.

It is simply a question of reasonable insurance against great financial loss. Thus the national forests represent a value of over two billion dollars at the most conservative estimate. The annual gross expenses of administration, protec-



FALLEN TIMBER IN A WASHINGTON FOREST

Many virgin forests in the Northwest have an immense amount of down timber, making fire protection extremely difficult

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WALLACE, IDAHO, AFTER THE FOREST FIRE OF 1910: ABOUT 200 BUILDINGS WERE DESTROYED

tion, permanent improvements, and all other work upon them amounts to only about two and one-half cents per acre, or about two and one-half mills on each dollar of valuation. The net cost, after deducting receipts, cuts this in two, and in a few years there will be no drain on the government at all, as the receipts will more than balance the expenses.

In this connection it may be added that Prussia spends about $2.50 per acre annually on its public forests, and France about $1 an acre. Even British India spends over twice as much per acre on its public forests as the United States.

PROTECTING OUR NATIONAL FORESTS

The protection of the vast domain of our public forests has been a gigantic task, inasmuch as the national forests are located chiefly in the mountain regions of the West, and, including the forests in Alaska, comprise a gross area of about 190 million acres.

These forests are still, for the most part, in a state of undeveloped wilderness. When first organized there were in the forests almost no means of transportation and communication; thousands of square miles were almost inaccessible for patrol or for transportation of men and supplies in case of fire. The forests themselves are chiefly composed of coniferous species, a type of forest far more exposed to serious fires than those composed of hardwoods. In many sections there is a prolonged dry season in the summer, during which the fire danger is critical.

The first step taken was to organize a force of men, properly distributed, to patrol the forests and to fight such fires as occurred. Accordingly the forests were divided and subdivided into such divisions and districts as were necessary for effective organization. The effort was at once made to remove as fast as possible the causes of fires, because the aim of organized protection is to prevent fires from starting at all. This condition is, however, a long way off, and in the meantime preparation must be made to reach quickly fires which may occur, and with the necessary means to extinguish them.

The causes of fires may be well illustrated by the record of those occurring on the national forests in the year 1911, as follows: Railroads, 33 per cent; lightning, 14 per cent; incendiary, 6 per cent; brush-burning, 6 per cent; campers, 13 per cent; saw-mills and donkey engines, 1 per cent; miscellaneous, 5 per cent; unknown, 22 per cent. These are all preventable causes, except lightning.

The principal danger from lightning lies in the fact that there are throughout the forests standing dead trees and old snags which are dried out and easily ignited when struck. Ultimately, when the forests are fully opened up and developed and these old snags are removed, the principal danger from lightning fires will have been removed.

Railroad fires will be eliminated when it is a requirement for locomotives to burn oil or carry adequate spark arresters. Pending the time when this can be accomplished, the forest service is requiring the clearing of rights of way of inflammable material and careful patrol of the tracks in coöperation with railroads. The number of railroad fires were reduced within the last year by five per cent.

Most fires from other causes are due to carelessness. Education of the people to exercise care in the use of fires on the forests and strict enforcement of laws and regulations is gradually bringing about a change in this respect. Time is required to bring about this reform, although great advances are being made every year. Meanwhile, as it is inevitable that fires will start here and there in the public forests, the government must be in position to stop them before there has been time for them to develop into conflagrations which cause serious damage.

It is recognized that effective fire prevention is impossible until the forests are opened up with means of transportation and communication and are otherwise equipped with improvements for fire fighting. The ordinary virgin forest, especially one which has already been more or less damaged by fire, is littered with fallen trees and other débris, which make it impossible to penetrate to

A FOREST IN MONTANA KILLED BY THE FIRE OF 1910

In this fire, which swept over from Idaho, 79 fire-fighters perished. Some were killed by falling trees

different portions without roads and trails (see photos, pages 672 and 673).

A fire started by lightning or other causes in a remote place may be practically inaccessible, requiring two or three days to reach it. By that time the fire may have attained proportions which necessitate a terrific fight with perhaps a force of several hundred men before it can be subdued. Trails are therefore absolutely necessary, both in order that the forest guards can adequately patrol the forest and in order that men, equipment, and supplies can be transported quickly to all parts of the forest in case of need.

Such a system of trails is being built in the national forests as rapidly as funds are available. Already nearly 10,000 miles have been constructed. There are required, however, fully 80,000 miles more in order to establish the first skeleton system of trails. This will be equivalent to about 10 miles of trail for every township of 36 square miles.

In the long run a much more extensive development of trails will be required; but this primary system is absolutely necessary before it will be possible to really gain adequate mastery over forest fires.

TELEPHONES AND LOOKOUT STATIONS

The distances in the national forests are so enormous that, in addition to the roads and trails, there must also be a system of telephone lines. The Forest Service has already built about 7,000 miles of telephone line, but about 45,000 miles more are required to complete the primary system of control. These telephone lines enable instant communication between the headquarters of the forest supervisors and the rangers and also connect with the lookout stations. There has recently been developed a portable telephone set, which is carried by the patrolmen, so that they can tap a line at any point and report a forest fire to headquarters without having to take the time to go to a ranger station or other central point.

Still another very important development for fire prevention is the establishment of lookout stations. In the mountains advantage is taken of prominent peaks which command a view of an extensive area. An equipment is provided which enables the watchman to locate fires quickly. There is usually a firmly mounted table, on which may be placed a map of the surrounding region. A telescopic or simple alidade enables the watchman to sight a fire and at the same time to determine on the map its precise direction from the lookout station.

The watchman is always a man fully acquainted with the region and is usually able to determine on what watershed the fire is located. He immediately telephones to the ranger station nearest the fire, and a man or men are dispatched to put it out. Usually there are two or more lookout stations on a forest. When a fire may be seen from two stations in communication with each other its precise location can be fixed.

Where the topography is such that high points or natural lookout stations cannot be found, high towers are built; in some instances of rough poles; in other cases of lumber, and recently many steel towers have been constructed.

During the past season fires on the national forests have been located from lookout stations as far away as 50 miles, and as a result of the quick reporting of the location the fires have been promptly extinguished.

Still another means for fire prevention is the fire line. A dirt road is the best possible fire line, but general road construction must follow after the construction of trails and telephone lines. It is expensive work and not so immediately essential as the other development. In many instances, however, it is necessary to construct at once fire lines from which all small growth and inflammable material down to the mineral soil is removed. Some 500 or 600 miles of such fire lines have been built on the national forests.

One of the very important classes of improvements in a large forest is the ranger stations, which are well located with respect not only to the conduct of business in the forest but to fire protection. Many serious fires have been prevented because they were within striking distance of the ranger station.

With all this permanent improvement

FOREST-SERVICE TRAIL IN A DENSE MONTANA FOREST

If the forests had been fully provided with such trails the disaster of 1910 could have been either prevented or the loss reduced to a small amount. There have been built in the national forests about 10,000 miles of trails. Fully 80,000 miles more must be built for the primary system of fire protection.

work done, it is then necessary that there be ample equipment to meet emergencies—fire-fighting tools, such as grub-hoes, axes, rakes, pails—and such other material as the special conditions of a given forest require. This equipment must be located where it will be most useful—at ranger stations and in special boxes located at convenient places.

It is, further, most essential that there be provision for the transportation of men and supplies in case of fire. In some cases where there are no roads and transportation is entirely by trail it is necessary to equip a forest with a pack train. Elsewhere arrangements are made in advance to hire such transportation as is needed when occasion arises.

The key-note in fire prevention is preparation. This applies not only to the development and equipment of the forest, but also to the organization of the protective force. The great difficulty in the national forests has been that the appropriations have not been large enough to permit the employment of enough guards and patrolmen.

At present the average area in charge of a single man is about 100,000 acres. In some cases of very valuable timber it has been possible to place one guard to each 30,000 acres. A single patrolman should not have to cover over 10,000 acres when the timber is heavy and valuable. Elsewhere one man to 20,000 or 25,000 acres may be sufficient if the forest is equipped with trails, telephones, and other improvements.

The Forest Service has been able to accomplish what it has only through the most careful organization and the efficient and loyal service of its rangers. Careful fire plans are prepared which provide in advance for the placing of the patrol, the coördination of the different patrolmen, the distribution of fire-fighting equipment, the securing of men and supplies and their transportation in case of fire, and all other matters which are needed in an emergency.

THE PRACTICE OF FREQUENT BURNING OF THE WOODS VERY INJURIOUS

It has been the practice in some sections of the country to burn over the forest every year or two on the theory that light annual fires are beneficial in preventing the accumulation of inflammable débris, which if allowed to gather in quantity might cause fires of great proportions.

This practice of frequent burning of the woods has been particularly prevalent in the forests of the southeast and in certain sections in California. It has been stoutly maintained by some lumbermen that this is the proper method of forest protection. These men point to the fact that trees of certain species have a thick corky bark which resists a light surface fire. Hence, it is maintained, the valuable timber is protected from fire, whereas if a thick leaf litter is permitted to gather and young pine trees to spring up a single fire would burn with such severity as to kill the old timber.

Of course, the advocates of this theory are interested only in the protection of the mature timber, and have no interest in the protection of the immature trees, or the promotion of a new crop after the first is removed. It is obvious that the repeated burning of the forest destroys the young trees and altogether prevents any new reproduction. The doctrine consists, therefore, of protecting a limited number of mature trees by destroying all the young ones. When the old trees are finally cut nothing but a barren waste is left (see page 683).

This process of ultimate destruction of the forest is illustrated in many parts of those forests where the practice of annual or periodic firing of the woods has been in vogue. The insistent promulgation of this dangerous doctrine by certain lumbermen in California has acted as a real obstacle to retard the establishment of effective forest protection in that State and stands out in sharp contrast to the progressive attitude of the lumbermen of the Pacific Northwest.

THE STATES AND PRIVATE OWNERS COÖPERATING

Following the methods used by the government, many large owners of timber lands are now undertaking to protect their property from fire. In the

A RANGER STATION: SEQUOIA NATIONAL FOREST, CALIFORNIA

The forest rangers are stationed at points most convenient for the conduct of their work. Their duties include not only protection of the forest from fire, but many responsibilities connected with timber sales, grazing, construction of trails, telephone lines and other improvements, free use of timber, boundary surveys, tree-planting, etc.

FOREST OFFICERS EQUIPPING THEMSELVES TO GO TO FOREST FIRE: COLORADO

An important part of the equipment of the forest consists of the tool-boxes, located at strategic points

Northwest several fire protective associations have been formed, through which the lands of the members are handled under a single protective organization. Their example has been followed by lumbermen in certain parts of the Lake States and in northern New England. Very little progress has, however, been made among the owners of large tracts in the South.

Those States which have initiated a policy of State forests are protecting their public property from fire. These and other States have gone further and are undertaking to aid the private owners in fire prevention. The individual owner is always at a disadvantage if his neighbor is careless.

A great many States have excellent laws for the punishment of carelessness in the use of fire, but only about 14 States have developed a system of protection based on the principle of patrolling the forests to prevent fires, just as is done on the national forests. Under the system of State patrol the State does not bear the whole burden, but directs the work and contributes such an amount as will insure effective organization.

The States which have inaugurated such a system are New York, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New Jersey, Maryland, Michigan, Wisconsin, Minnesota, Washington, and Oregon. Others will soon follow. Pennsylvania has a progressive policy of State forestry, but has not yet introduced a system of patrol on private lands under State direction. These various States have not yet perfected their organizations, nor have they covered the whole forest areas within their boundaries. They have inaugurated the right policy and need now only money enough to put it into full practice.

The government extends a certain amount of direct aid to the States in protecting the forests on the watersheds of navigable streams. The Weeks law, passed in March, 1911, provided $200,000 for this purpose. The law requires, however, that no State shall receive more than it appropriates from its own treasury for fire protection. In 1911 ten States received aid from the government under the Weeks law. In 1912 probably 12 will receive such aid.

TELEPHONE CONSTRUCTION IN THE FLATHEAD NATIONAL PARK: MONTANA

The forest service has already built 7,000 miles of telephone lines in the forest reserves, but 45,000 miles more are required and will be constructed as soon as funds are available

From the foregoing it will be seen that enormous advances have been made in fire protection in the last few years. The annual fire loss is being very greatly reduced. The problem is, however, by no means solved. There is still required a great deal of public education, to eliminate carelessness in the use of fire in the forest. Many States have not yet adequate fire laws, and the appropriations for fire protection by the States and by the government are still inadequate.

A LONG-LEAF PINE FOREST IN TEXAS, 12 YEARS AFTER LOGGING, WHICH HAS BEEN BURNED REPEATEDLY

There is no young growth at all. When the remaining trees are cut the destruction of the forest will be complete (see page 679)

THE EFFECT OF PROTECTION OF LONG-LEAF PINE FORESTS FROM FIRE

XUM

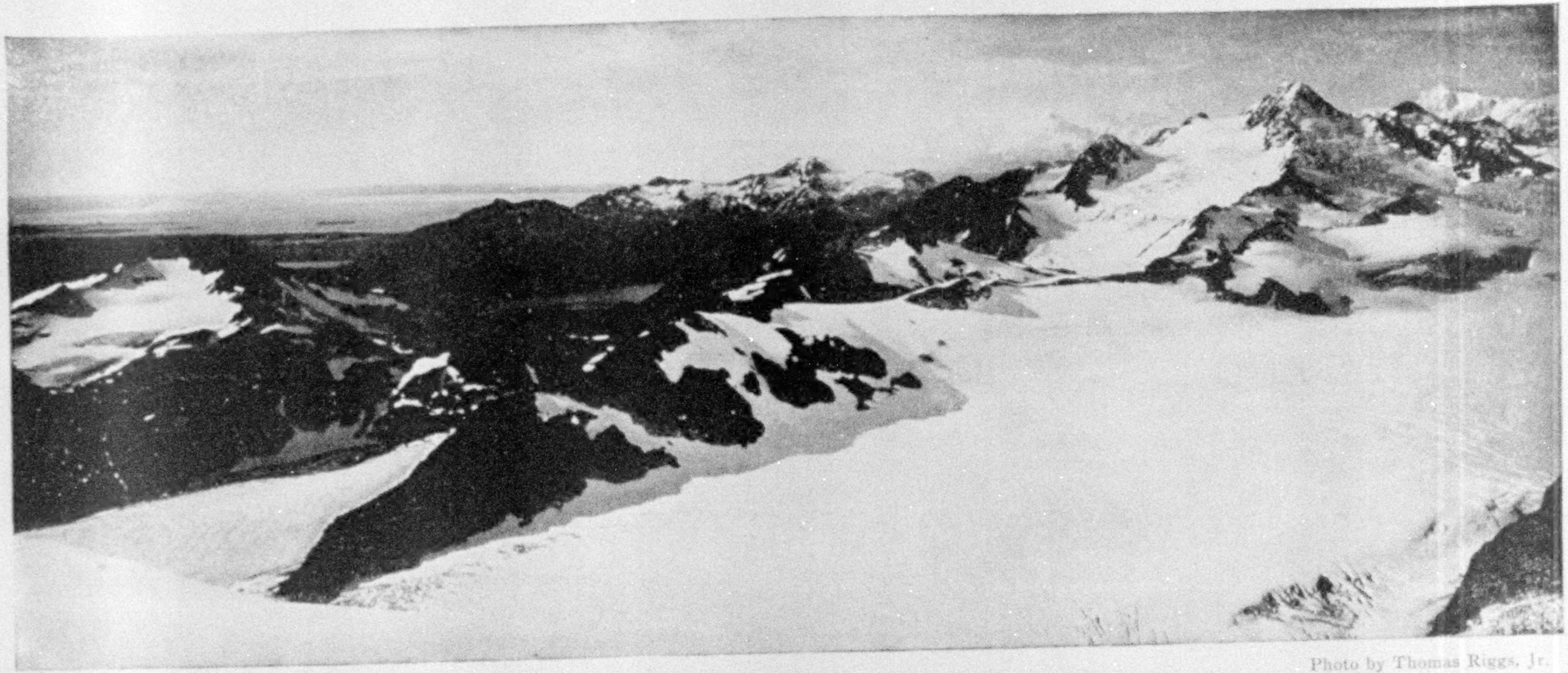


Photo by Thomas Riggs, Jr.

MOUNTAINS NEAR YAKUTAT BAY, ALASKA

Mount Saint Elias is seen in the distance. From a ridge of Saint Elias the 141st meridian, defining the Alaska-Canada boundary, starts on its journey to the Arctic Ocean

SURVEYING THE 141ST MERIDIAN

By Thomas Riggs, Jr.

Engineer to the Alaska Boundary Commission

FAR to the north, in latitude 60° 20', towering high above other mountain giants, stands Mount Saint Elias. From a ridge of Saint Elias, and running north straighter than the crow flies, is the 141st meridian of west longitude, which is the dividing inland line between the possessions of Great Britain and that of our own much-abused Alaska.

From its starting point, near Mount Saint Elias, the boundary shoots for 60 miles over the great ranges and glaciers of the Saint Elias Alps to the broad valley of the White River, where the prospector patiently drives his tunnels on lodes of copper and gold and prays nightly that the Copper River and Northwestern Railroad, now built up the Chitana River to Kennecott, may be pushed over the high Scolai Pass, thereby making his wares marketable. What is it to the pioneer if the railroad should charge as much as $75 per ton, for is not the present rate 35 cents to $1 *a pound* from Whitehorse to Canyon City, on the White River (see map, page 693).

Just south of the White River, from the summit of Mount Natazhat the eternal snows cast their last defiance at the boundary. From here even to the Arctic Ocean there exists a season of the year free from ice and cold.

The many channels and quicksands of the White River being passed, the country changes to the lower rolling hills so beloved of the white sheep, and to the low, lake-dotted muskeg marshes inhabited by the wide-antlered moose—a veritable hunter's paradise, where sheep, moose, caribou, and bear may be had at almost any time; where greyling are not caught on hook and line, but are kicked out of the water, and where the Western packer calls to the cook: "You blank stomach-robber, ain't you never no more going to cook no beans?"

Across Ladue River, where the stream flows twelve miles to go three in a straight line; past the head of the Sixty Mile River, the scene of the latest gold rush; through Alaska's pioneer diggings of the Forty Mile; into the Yukon Valley and up the abrupt north bank; across the hills of the Tatonduk, the home of the Fannin sheep; across the Nation River, and across the barren hills and ridges of the Kandik; over the bottomless marshes of the Big Black River, nightly made hideous by the long-drawn howl of the packed timber wolf; on, on, always north; over the Porcupine, skirting by Rampart House, one of Canada's most northerly trading-posts; through the lake country of the Old Crow; over Ammerman Mountain, the Davidson Range, the British Mountains; then down to the terminal monument, to be placed on the bleak shore of the Arctic Ocean—so runs the 141st meridian of west longitude; in all, roughly speaking, a distance of about 600 miles.

Working under the direction of a joint American and Canadian commission, for five years we have struggled with this, the straightest of the world's surveyed lines, and this year it was given to some, from the high summits of the British Mountains, like Moses from Pisgah, to gaze upon our goal, and to see the deep blue of the Arctic, dotted with the dazzling white of wind-driven ice-floes.

The actual visible results of the work consist of a vista 20 feet wide cut through all timber, monuments set at intervisible points not more than four miles apart, and a detailed map of a strip of country extending for two miles on each side of the boundary. At prominent river crossings and at the main points of travel, the monuments are 5-foot aluminum-bronze sectional shafts, each weighing about 300 pounds and set in a ton of concrete. At less important points are the 3-foot aluminum-bronze cones set in about 1,500 pounds of concrete. All monuments are geodetically determined and will be the bases for future surveys of Alaska.

The maps, when published, will be among the finest of their kind in the

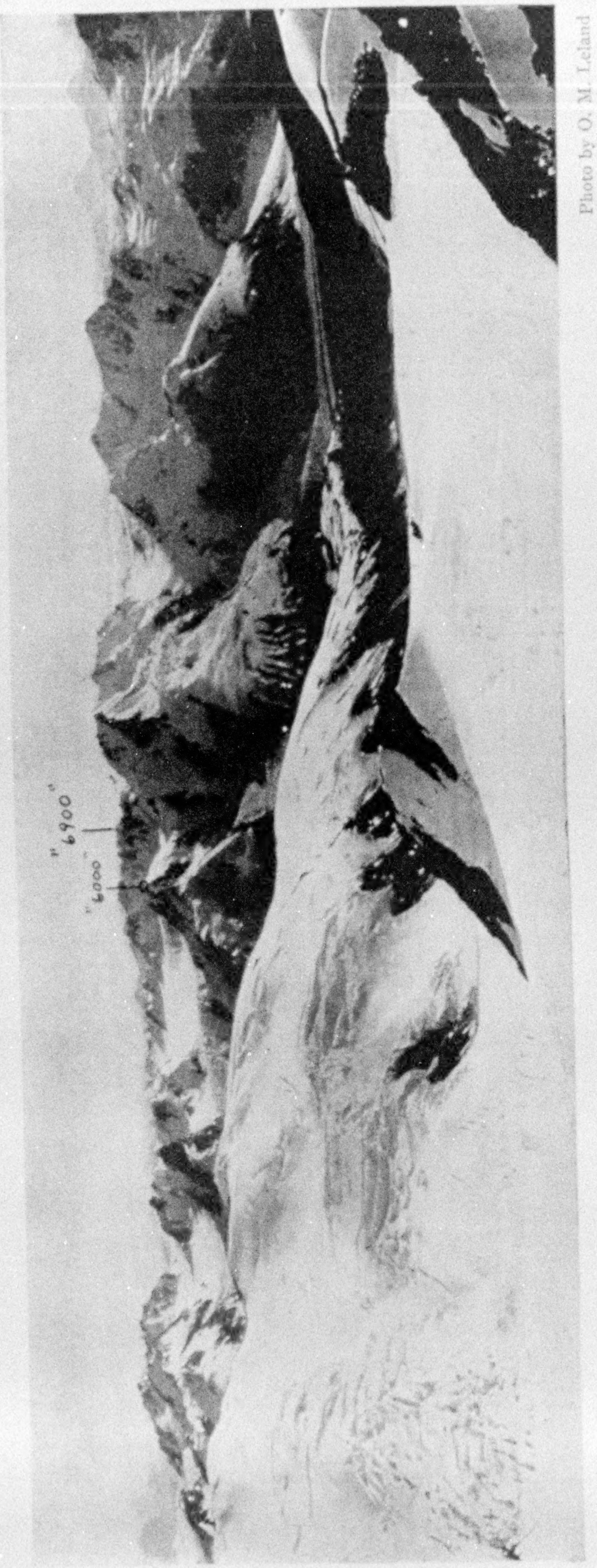


Photo by O. M. Leland

BOUNDARY PEAKS FROM A TRIANGULATION STATION

On the coast the boundary jumps from peak to peak at an approximate distance of ten marine leagues distant from tidewater. These peaks need not all of necessity be climbed, but may be geodetically determined from triangulation. Even this work calls for the most strenuous sort of mountain climbing.

world; besides showing the differences of elevation and drainage, they will also differentiate, by means of symbols, between the various growths of timber and show their density. The character of the country, whether of swamp or tundra, will also be shown. A line of precise levels, run from tidewater to a point on the boundary, furnishes the initial elevation for mapping, whence elevations for triangulation are taken and extended trigonometrically both north and south.

This survey has probably had more obstacles to overcome than almost any other survey of recent times. In the first place the meridian is crossed in only two places by possible routes of water transportation—at the Yukon River and at the Porcupine. For 225 miles south of the Yukon, supplies, forage, camp outfit, instruments, and personal effects must mainly be carried on the backs of horses. An occasional road, knee deep in mire, over which a six-horse team can barely pull their 40 hundred, will run out a short distance from such places as Dawson or Whitehorse, but the main reliance of the party is placed in the pack-train wending its snaky way over hill, tundra, and swamp. Two miles an hour is the average speed of this freight train, and six hours a day is considered long enough for a horse to carry his heavy burden.

On a forced march of

nearly 300 miles, my train of 56 horses averaged about 16 miles a day for 17 days, but the trail was frozen and hard and frequent caches of grain were on the line of travel. Another time, late in the autumn, coming from 30 miles north of the Arctic Circle to the Yukon River, we were 23 days on the trail, a distance of not more than 200 miles. Of the 75 horses with which we started, only 44 reached the river.

Eight days out from the Yukon we abandoned everything possible in the way of camp equipment; six days out and every man in the detachment of 30 men was forced to carry his 20 pounds; four days out, in a blinding snow-storm, one of the topographers set out to get a train of 12 horses which had preceded the main train. He started at 10 one morning, reaching the Yukon camp in time for breakfast the next morning. He had forded two raging torrents in the night and crossed a high summit deep in snow. The relief train met us two days out, bringing the precious grain.

In summer one can fight mosquitoes and keep fairly comfortable, but in the long retreat after the dark nights have come, when snow covers the trail, when ice is thick enough to just break through with the weight of man, when the wolves howl around the camp, when in the morning huge fires must be built to thaw out tents and pack-rigging, while packers freeze their fingers tying packs on dejected and shivering ponies—then the true spirit of the man is manifested and the "cheechako," as the tenderfoot is called, shows whether he is worthy of the life of a sur-

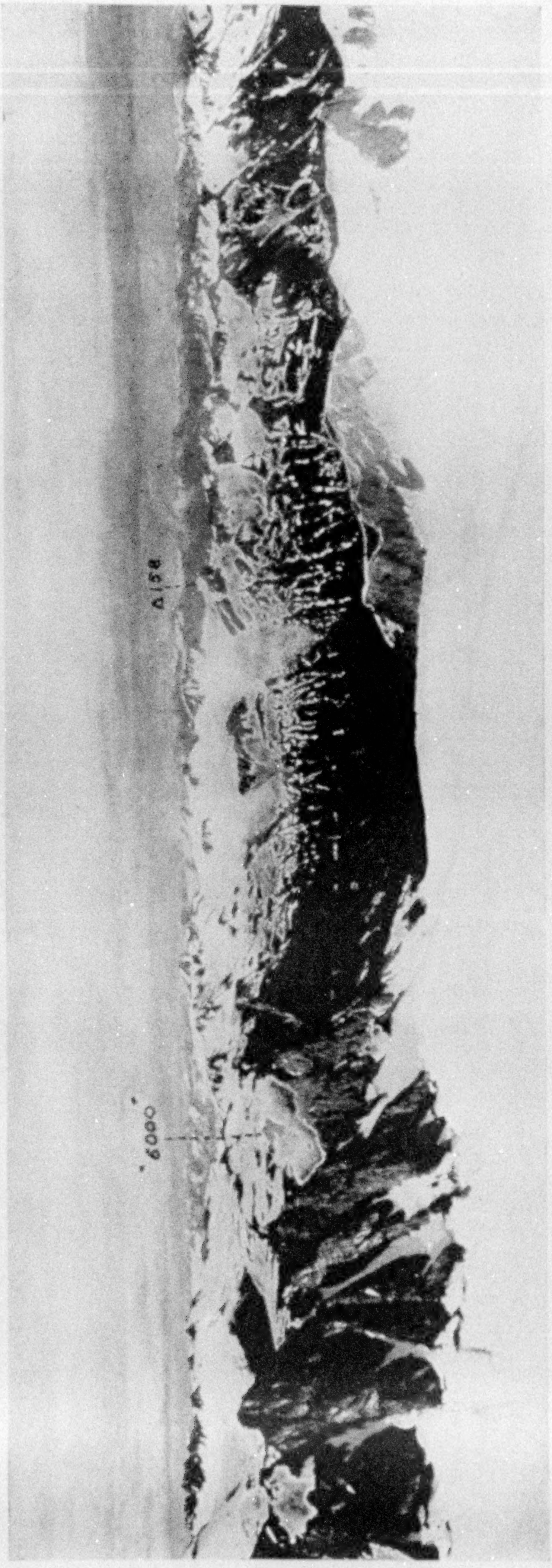


Photo by O. M. Leland

VIEW FROM SUMMIT OF BOUNDARY PEAK "6900" (SHOWN IN PRECEDING ILLUSTRATION), SHOWING A BOUNDARY PEAK AND ANOTHER TRIANGULATION STATION

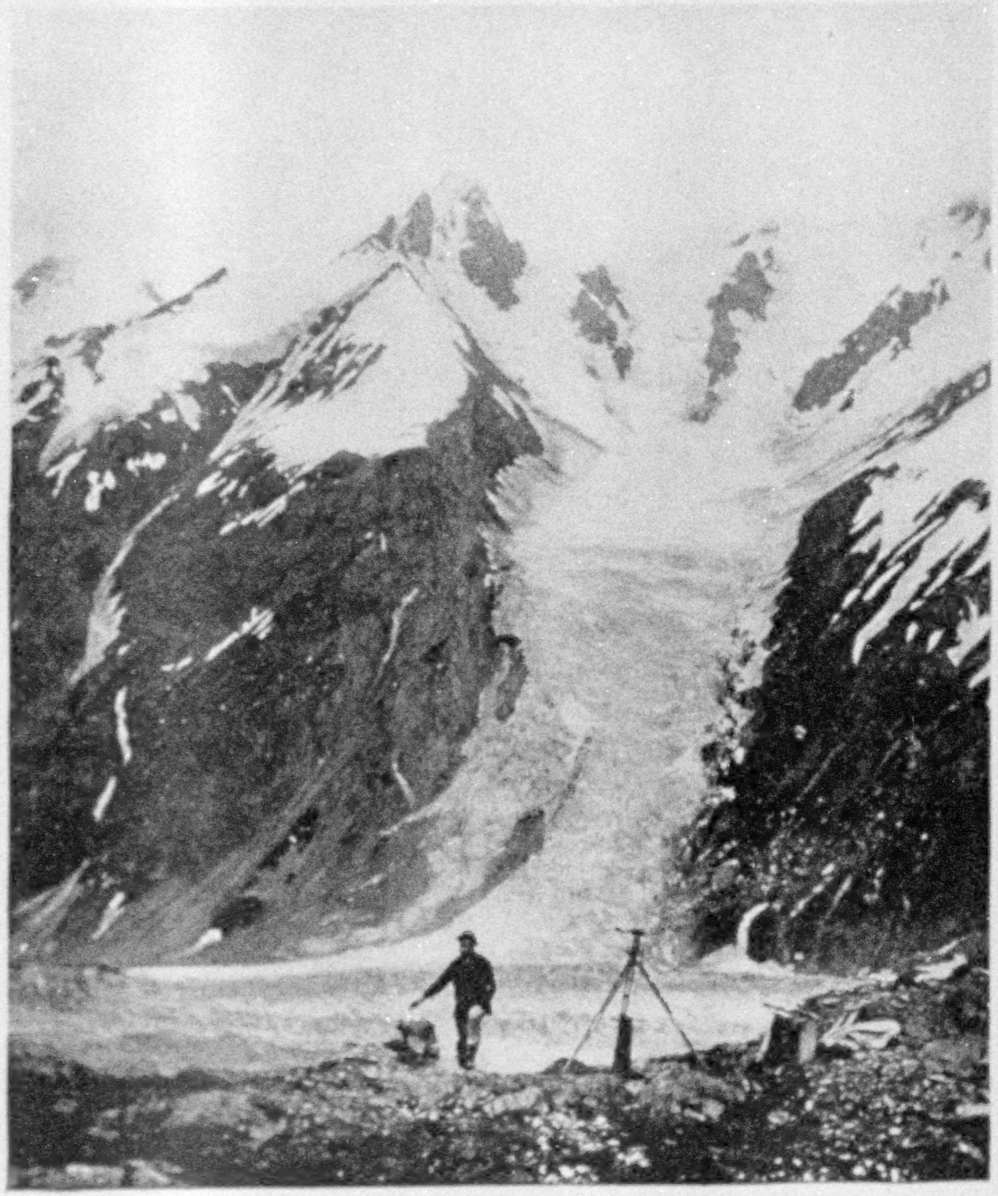


Photo by O. M. Leland

BOUNDARY MONUMENT NEAR THE SALMON RIVER

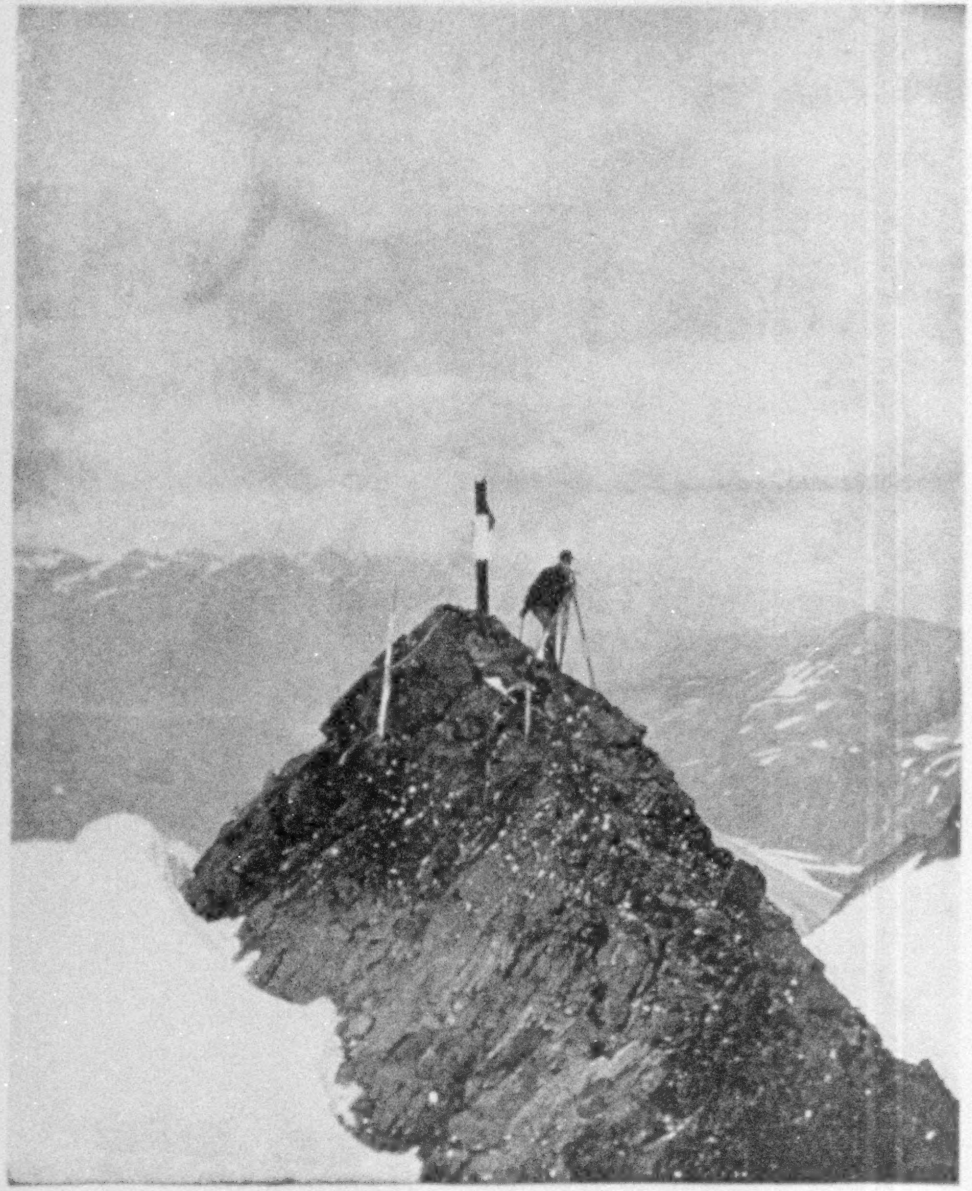


Photo by O. M. Leland

A TRIANGULATION STATION

Photo by O. M. Leland

WORKING ON THE COAST BOUNDARY; PREPARING TO CROSS THE DE BLONDEAU GLACIER

veyor, or whether his adventures in life should be limited to the selling of pink and blue ribbons.

Not uneventfully has the boundary between Alaska and Canada been run. Fire, shipwreck, accident, disease, and death have trailed the footsteps of the surveyor.

During my first season on the 141st meridian, while in camp on the Yukon River, I was suddenly called from my instrument by the cook shouting that a body was floating in the river. Sure enough, bobbing serenely along with the current was an unmistakable black object. Hurrying into a canoe, we tied a rope to the body and towed it to shore. It proved to be the body of an ex-dog-driver of the Northwest mounted police, who had been drowned at Dawson some four weeks previous. For the sake of the astronomic work, the wire had been tapped at the boundary and we were in communication with Dawson, the nearest Canadian town, and with Eagle, which is on the Alaskan side. With characteristic promptness an officer of the police appeared on the scene.

Captain Tucker, of the police, instituted a coroner's court on a stump and took evidence.

"Where was the body landed?"

"Just below the boundary."

"Sorry I can do nothing in the matter, as the body was found on the Alaskan side."

Captain Tucker packed up his papers and went home.

I went to Eagle and interviewed the United States commissioner. Yes, he was very sorry, but in the Alaskan code there is no provision for burying the dead. In effect both governments said: "He's all yours; we don't want him." We knocked together a rude coffin, made from packing boxes, wrapped the poor, discolored body in canvas, and lowered it into a shallow grave back of the old Boundary Creek road-house. There was less profanity than usual at supper that night.

Pope and I traveled down the Big Black River on a raft last year to a triangulation station. While walking back a sudden storm overtook us near one of the little trap cabins frequently found in the most unexpected places. We broke in and waited until the fury of the storm was past. On the cabin door were written the names of two men, with the information that they had left in June and would be back in September.

This year a broken raft on a log-jam, a torn tent, and a rusted rifle were found far below the little lonely cabin, but the men themselves have never been seen.

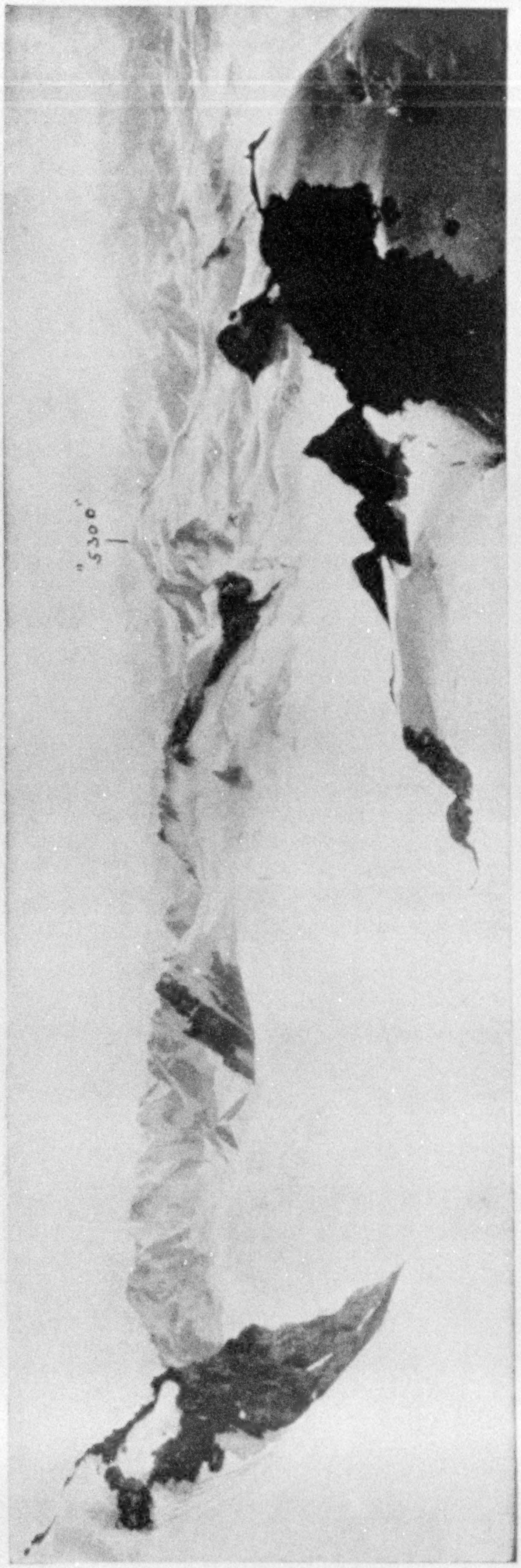


Photo by O. M. Leland

BOUNDARY PEAK "5300" FROM A TRIANGULATION STATION

Such tragedies are common in the North.

The survey party itself has paid toll. Two efficient, energetic young American surveyors have been cut off in the prime of their life as a result of hardship and injury received in the line of duty. The Canadians have lost one of their brightest chiefs of party. A cry and a dark shape hurtling through a thousand feet to a glacier below was the last of another of their adventurous mountain climbers. Two are in pauper asylums for the insane.

While there is much that is grim in the life of the pioneer, still there is much to enjoy.

This year, landing at Rampart House, a scene of wild excitement ensued among the Indians. Never before had they seen so many white men, never a horse, never a steamboat; and when, without tow-line or sail, the little steamer *Delta* nosed her way up the Sunaghun Rapids, spitting smoke and steam from stack and pipe, their wonder was unbounded. A hundred white men—it was incredible. They pressed around, each one eager to be the first to shake hands and say "How do," all the English they knew.

On the high bank stood the log store, surrounded by the various buildings of the trading-post, for all the world like the posts of the "Honorable Company of Gentlemen Adventurers of England trading into Hudson's Bay" of a hundred years ago. Beneath the tall flagpole, from which waved the flag of Canada, in bold relief against the white-mudded buildings, stood the picturesque figures of the trader and his head assistant, moccasin on foot and the red toque set jauntily over the weather-beaten face, with the high cheek bone and steady eye of the North.

The steamers *Delta* and *Vidette* disgorged their cargoes of men and horses. As the horses were turned loose to run and roll in the flat back of the Indian village, a wild scramble ensued. Hundreds of dogs fled

Photo by O. M. Leland

SURVEYORS NEAR THE BASE OF BOUNDARY PEAK "5300"

The boundary tribunal selected certain mountains, which were designated as boundary peaks; "5300" refers to the approximate elevation

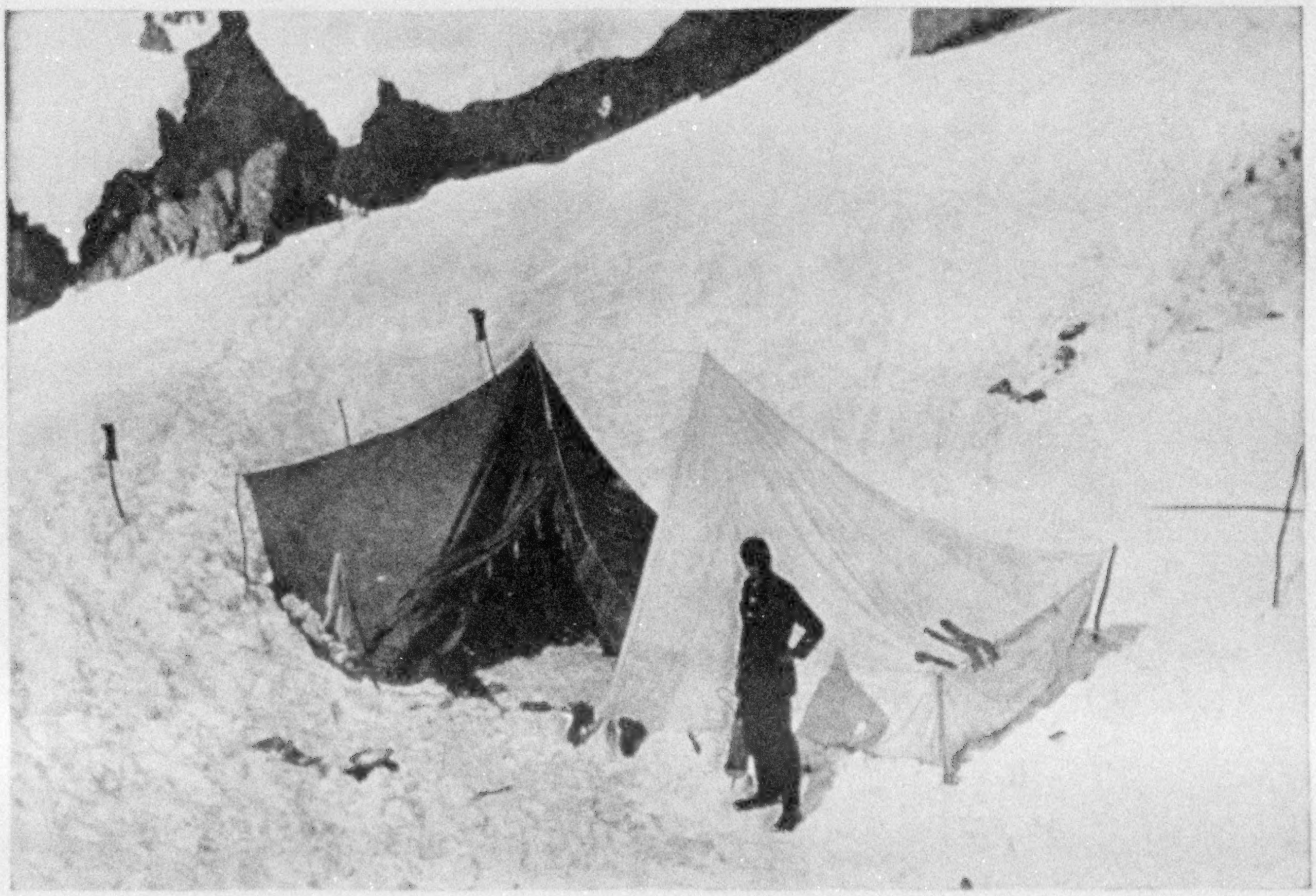


Photo by O. M. Leland

SURVEYOR'S CAMP FAR UP ON A MOUNTAIN SIDE

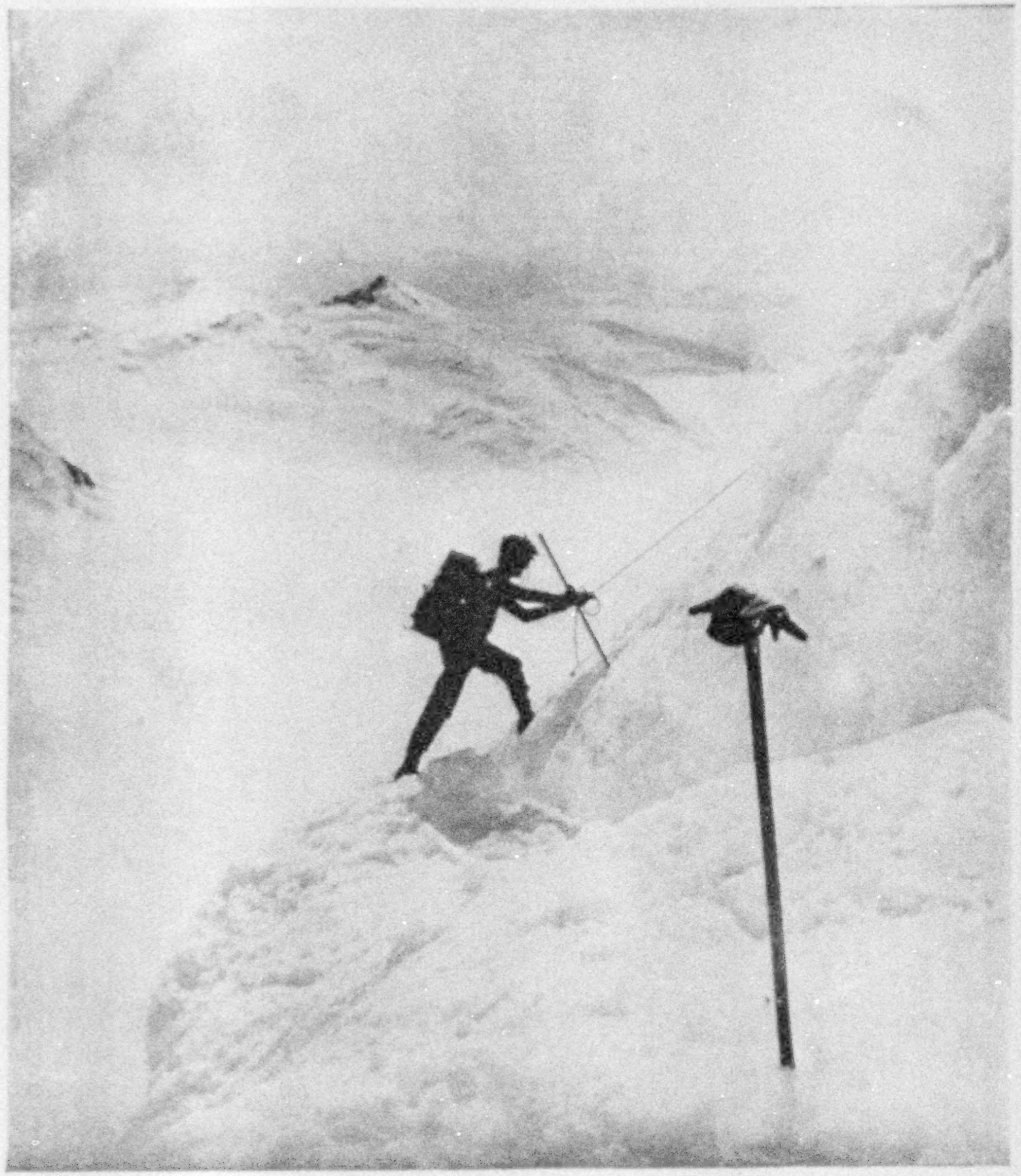


Photo by O. M. Leland

SURVEYOR ASCENDING BOUNDARY PEAK "5300"

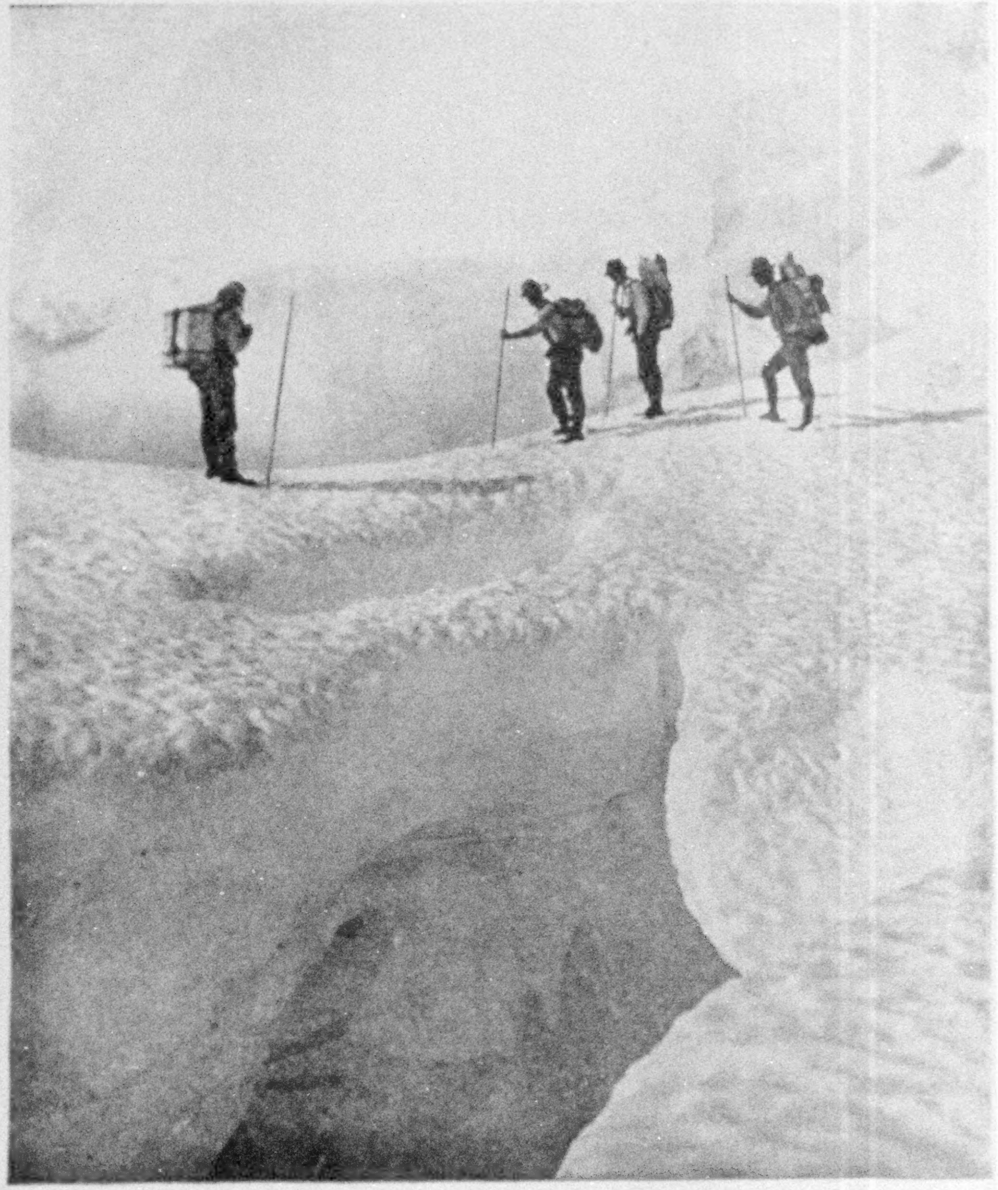
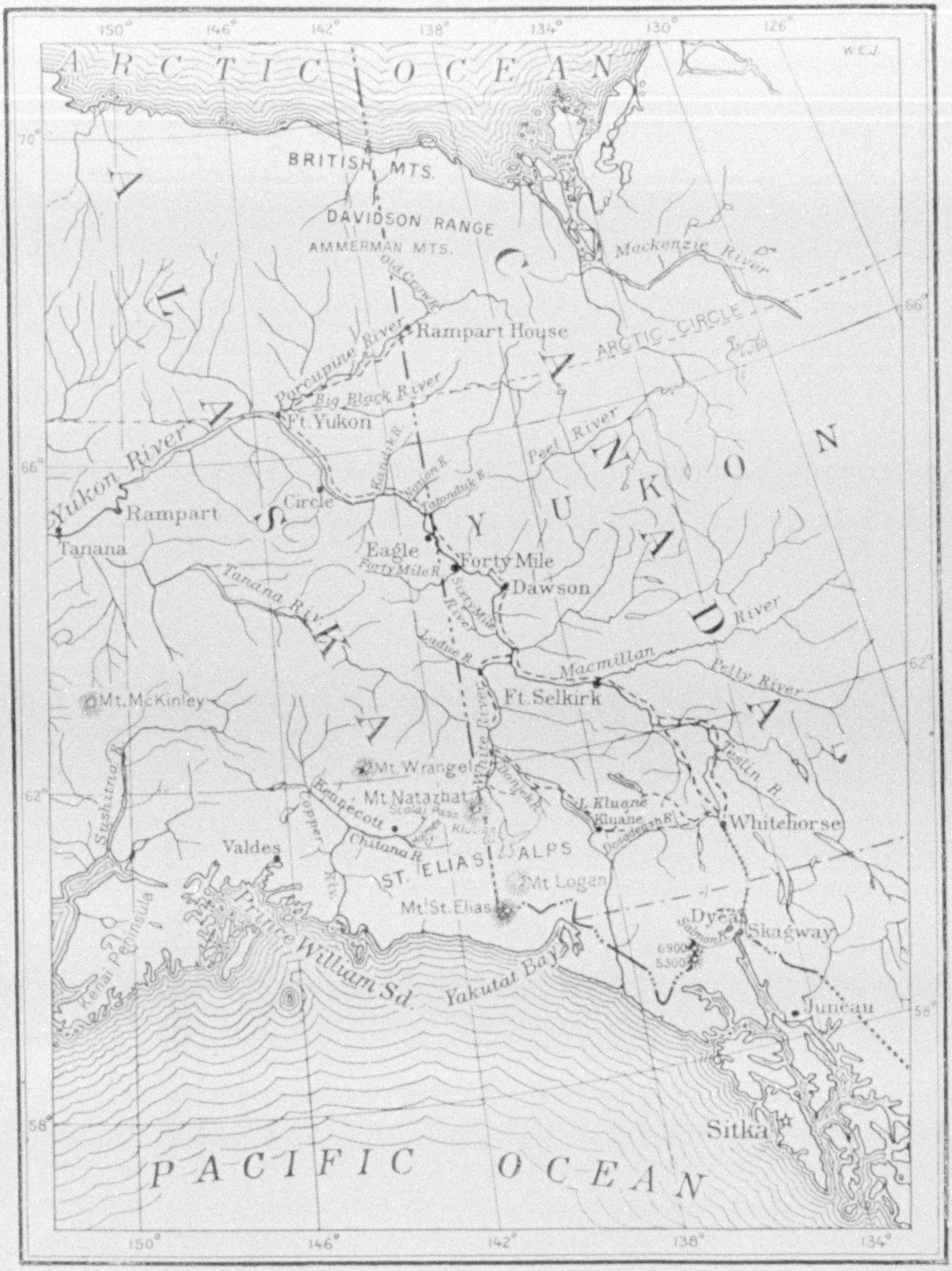


Photo by O. M. Leland

CLIMBING A CREVASSE ON A SNOW BRIDGE WHILE ASCENDING "5300"

Note the heavy packs borne by the surveyors



OUTLINE MAP SHOWING ALASKA-CANADA BOUNDARY LINE

The heavy black line along the 141st meridian denotes the completed part of the boundary. The coast boundary, ending at Mount Saint Elias, is practically completed. The dotted lines show the routes followed from Whitehorse when going to the field.

"The maps, when published, will be among the finest of their kind in the world; besides showing the differences of elevation and drainage, they will also differentiate, by means of symbols, between the various growths of timber and show their density. The character of the country, whether of swamp or tundra, will also be shown. A line of precise levels, run from tidewater to a point on the boundary, furnishes the initial elevation for mapping, whence elevations for triangulation are taken and extended trigonometrically both north and south."

XUM

ON THE ROAD TO THE WHITE RIVER FROM WHITEHORSE: STUCK ON THE BEAR CREEK SUMMIT

One year an overland trip of 300 miles had to be made from Whitehorse to the White River before the parties could get to work. A start was made on May 1, before the snow had disappeared from the hills. In consequence the wagons were badly stuck in many places

Photos by W. R. Tuckerman

A BAD MUDHOLE ON THE WAY TO KLUANE

Sometimes a wagon would not go 50 feet without getting mired; then all hands would pry with long levers, while the teams would be doubled up. Ten horses are shown on this small load

Photo by F. Lambart

THE BOUTELLIER SUMMIT ON THE ROAD TO LAKE KLUANE

Lake Kluane is at the end of a so-called wagon road from Whitehorse, and 150 miles distant. The lake itself is 25 miles from end to end. This was made in a few hours, while on the return along the shore it took two days by pack-train.

to the hills, not to be seen, but to be heard for several days. Within 10 minutes not an Indian was to be seen. In their cabins, behind barred doors, for two days they whispered of the strange hornless caribou that wandered at will among the houses, kicked down their tents and upset their caches. At last the braver ones ventured forth, and before long the children were throwing stones at their former bogies.

A few days to sort supplies and stores, and then, with the bucking of green horses and the din of bells, the parties one by one faded over the hill and into the unknown North.

The American and Canadian parties, consisting of anywhere from 30 to 50 men each, do not operate as one large party. Instead numerous subparties are organized, averaging about seven men to the party, each in charge of a veteran surveyor, each one complete in itself and independent of the others, each with its own cook and pack-train. The only party which in any way could be called a joint party is the one determining the main points on the meridian. In this there are both American and Canadian surveyors, whose individual observations must check each other before the boundary is decided upon.

Long before the field is reached, the list of outfit is given to each chief of subparty, showing his share down to the last teaspoon and pound of flour. It is then up to him to see that his supplies last through the season. As provisions are brought to his camp by the supply train, they are checked from his allowance. In this way is avoided the game of "grab." Cooks and packers are notorious in this respect, and I have yet to see the cook or packer who did not think that his share of luxuries or forage was much less than that of some other cook or packer.

Between the surveyors exists a generous rivalry. Never in the history of the survey has any chief of party been found guilty of shirking work; instead he is always trying to do just a little more than the other fellow. This spirit soon permeates the entire force. At the start of

Photo by W. R. Tuckerman

SKIRTING AN OVERFLOW ON THE ROAD BETWEEN WHITEHORSE AND KLUANE

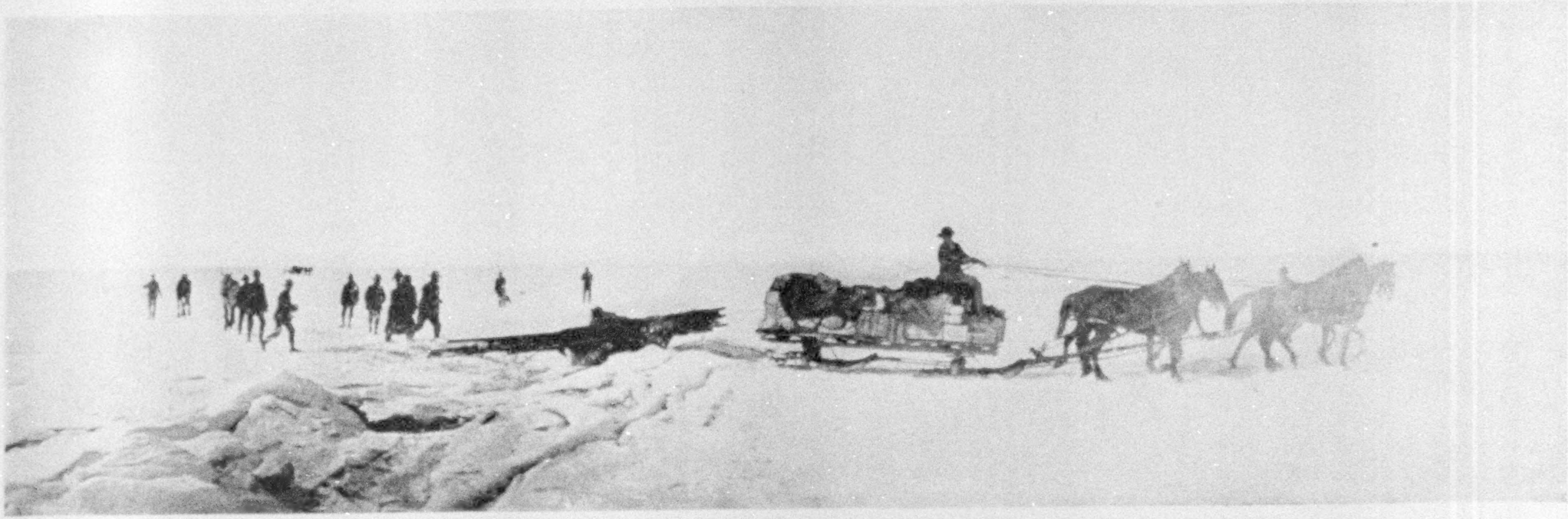


Photo by W. R. Tuckerman

CROSSING LAKE KLUANE: A PRESSURE CRACK

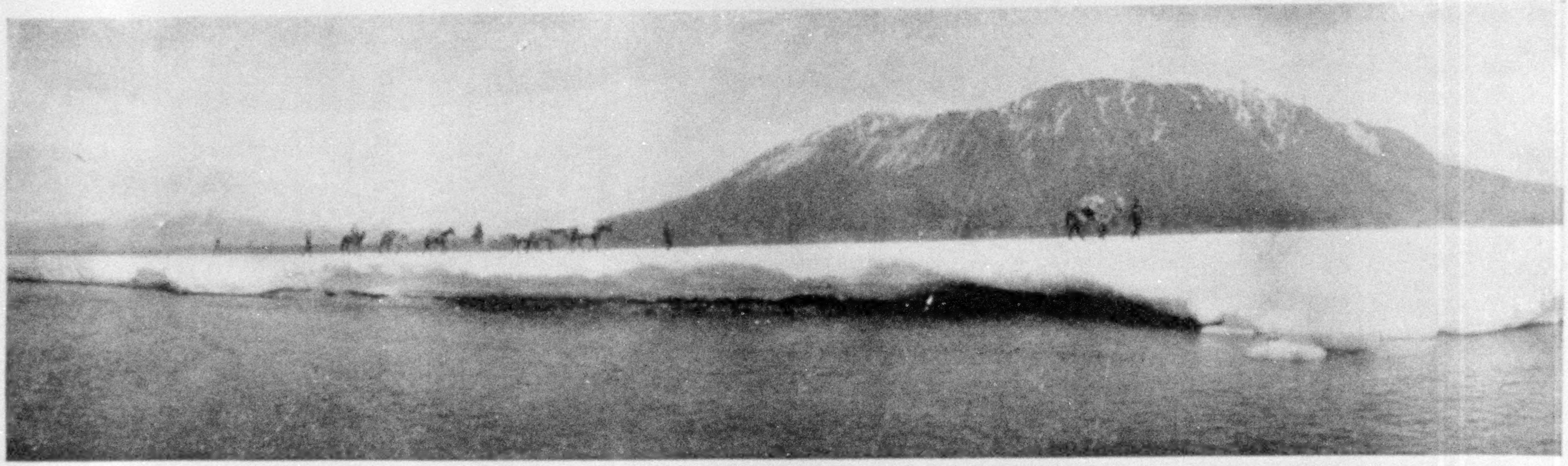


Photo by W. R. Tuckerman

FOLLOWING THE BANKS OF THE DONJEK RIVER

Good time was made when it was possible to travel on the ice. The glare is intense and snow blindness in consequence is common

ON THE ROAD TO THE WHITE RIVER: THE ALSEK MOUNTAINS AND THE VALLEY OF THE DESADEASH

This valley will undoubtedly some day be a great farming country. Photo by W. R. Tuckerman

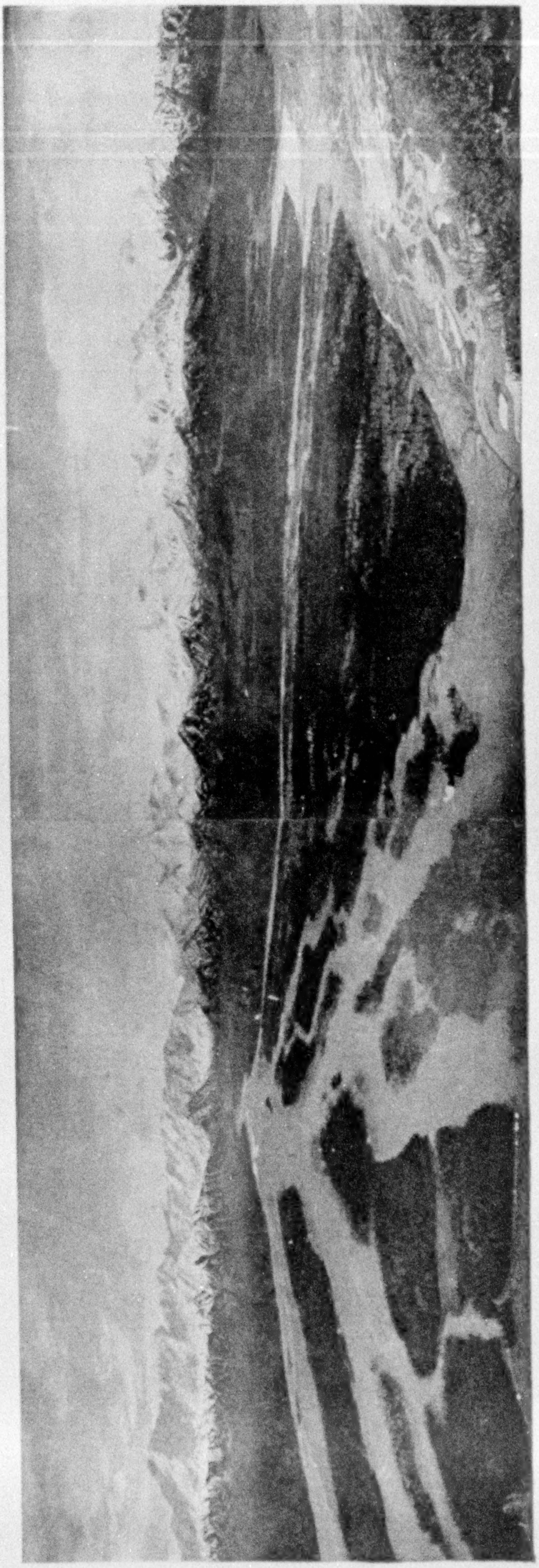


Photo by D. W. Eaton

MOUNT NATAZHAT AND THE MOUNTAINS TO THE WESTWARD

Holmes Creek flows from the mountains to the west of Natazhat. This was the divide crossed in the attempt to climb the mountain. The White River, full of dangerous quicksands, is shown in the right-hand corner of the photograph

the season, a green hand will sometimes complain of long hours and heavy work, but the older employees will not tolerate a loafer, and before many days he has caught the survey spirit, "That the man who is always willing to take the worst of it will find every other man always willing to take the worst of it."

Sundays do not especially exist as a day of rest, unless it is storming too hard to even move camp. To be sure, breakfast is had at 7 instead of at 6, and the men usually return to camp by 5. This applies to the Fourth of July and other holidays as well. Not a day can be wasted, for at the best a field season is only of 100 days' duration.

Incident there is in plenty, but it is soon forgotten in the next.

Reaburn, in advance of the main party, was going to Eagle from Dawson by canoe just after the opening of the river. Where the river narrows above Forty Mile there was a jam of ice. There was no chance to make the shore, so he headed for what appeared to be the most solid part. As he struck he drew his canoe onto the ice. When asked what he did next, he answered, "Got into the canoe and went to sleep." This with the ice cracking and breaking all around him.

Hardly a year goes by that some man does not get treed by a bear, and that special bear is always the largest bear in Alaska.

A pack of timber wolves tried to be friendly with a couple of packers on the Black River, but were beaten off.

That Providence which watches over babes and drunken men must also watch over surveyors, for with the risks which are taken I can-

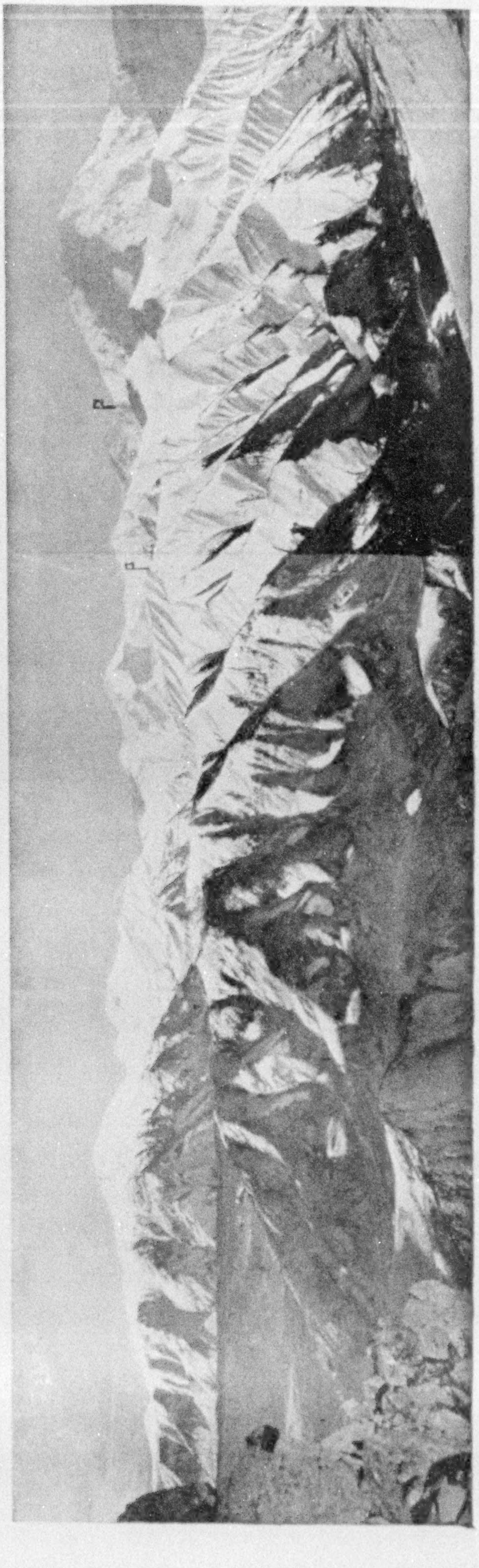


Photo by D. W. Eaton

MOUNT NATAZHAT FROM THE NORTHWEST

The Natazhat Range is the last of the perpetually snow-capped mountains along the 141st meridian

not explain why a dozen men have not been drowned or killed. With enough experiences each to furnish food for conversation for a lifetime, if you were to ask Reaburn, Gilmore, Ryus, Guerin, or Baldwin to relate some adventure they would not be able to recall one little one, for like Percy, the Machination Man of the Sunday supplements, "Of imagination they have nix." They are not parlor explorers or lecture-room adventurers. It is simply their life.

A steamboat wreck in the Thirty Mile River, freight gone astray, water too low to allow navigation for river steamers, caused Craig, the Canadian chief of party, and me to muster our fleet, consisting of the American power boats *Midnight Sun* and *Frontiersman* and the Canadian *Aurora* and *Pelican*, on the lower river to bring up supplies for the clamoring parties. Craig had gone to Fort Yukon, while I, with a relief cargo of 10 tons, on the *Midnight Sun* was pushing steadily and noisily up the Porcupine.

One day out from Rampart House we met the *Frontiersman*, the pilot of which brought an indefinite rumor of that most dreaded of all diseases among the Indians, smallpox. At Rampart House the rumor was confirmed. The little daughter of the Indian preacher showed a well-defined case. Our surgeon, Dr. Smith, had isolated the patient on the island, but no other steps had been taken.

It was a difficult problem. The boundary line with which we were taking such pains stood in the way. Here we were only 500 feet over in Canada and all Canadians away; but something had to be done to stop the spread of disease to the parties and to the surrounding country.

We debated five minutes. Stores were hurried to the *Midnight Sun*, telegrams to Dawson and to Washington written, and the *Midnight Sun* shot out into the rapids

Photo by Thomas Riggs, Jr.

MAPPING IN THE FOOTHILLS OF MOUNT NATAZHAT

Mapping is all done by the plane-table. While it is not necessary for the topographer to climb every hill, still he must choose his stations so as to see into every little draw to be mapped. This station is on the brink of an extinct volcano at an elevation of about 6,000 feet.

with hurry instructions to find Craig and place herself under his orders, while the writer and two others remained to help fight the smallpox.

The whole tribe was washed with antiseptic and, to the Indian mind, that strange and useless article—soap. Fresh clothing and supplies were issued to the members of the infected camp, who were isolated in a clean camp back of the Indian village. The camp in which smallpox started and the adjoining camps were burned with all their cherished possessions. There was some discontent manifested as precious furs and bead work disappeared in smoke, but this was promptly squelched with threats and a display of handcuffs. There were only three of us and we had to take a high hand.

Within nine days a tired crew of the *Midnight Sun* tied up in the eddy, but with them were Craig, a member of the Northwest mounted police, a male nurse, and vaccine. Without waiting for any confirmation of Craig's wire from Circle, the Dawson authorities had hurried the two men on board the first steamer, our launch had met them at Circle, and, by running day and night, had landed at Rampart House in record time. All expenditures were approved and our already established quarantine authorized. There are no half-way measures with the Canadian government in an emergency.

Thirteen days elapsed before there was another case, and for a time we thought that the trouble was over, but the Indians had all been exposed and now came down by families. The island assumed the appearance of an army bivouac. The Indians were all brought in from the hills and placed under supervision to prevent their scattering all over the country.

There is no law in Alaska to protect the community from an epidemic, so we arbitrarily took it and forced inspection and vaccination over a radius of 100 miles. Fortunately large quantities of supplies and clothing had been brought in for the use of the joint parties; these

Photo by Thomas Riggs, Jr.

SURVEYORS CLIMBING ONTO THE KLUTLAN GLACIER

The newly fallen snow covering the crevasses made the crossing of the glacier extremely dangerous. All three members of the party fell through several times, which, when carrying a hundred-pound pack, is decidedly unpleasant.

Photo by F. Lambart

CAMP ON THE SIDE OF MOUNT NATAZHAT: ELEVATION, ABOUT 9,000 FEET

Drying out all our changes of clothes the morning after the snowstorm

Photo by W. R. Tuckerman

MOUNT NATAZHAT FROM THE NORTH (SEE ALSO PAGES 698 AND 699)

Taken from an elevation of 7,000 feet. Mount Natazhat is 13,400 feet high

Photo by W. R. Tuckerman

THE PACK-TRAIN ON THE TRAIL

The load weighs from 150 to 250 pounds, depending upon the strength of the horses and the character of the trail (see pages 686-687)

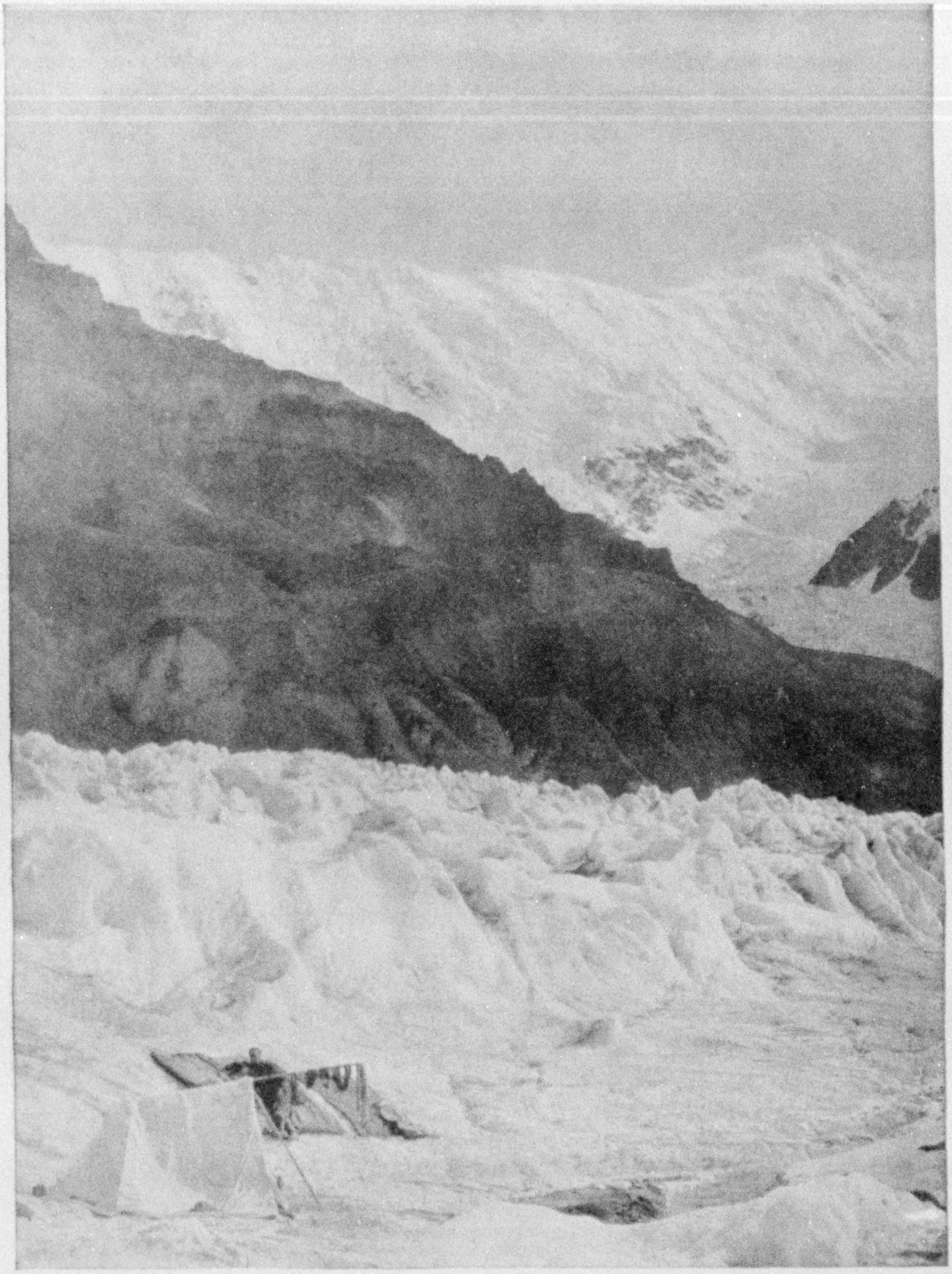


Photo by F. Lambart

SURVEYOR'S CAMP ON THE KLUTLAN GLACIER

were issued as needed. Had these supplies not been at hand the Indians could not have been controlled and a general outbreak of smallpox all over the Yukon would have been the result.

Now came the problem of getting the parties from the field without bringing them in contact with contagion. Pope and I gathered in both the Canadian and American parties and sent them across an unknown country, to hit the river far below the Rampart House. Craig stayed on the lid. Then, while Craig and a few of his party went into a two weeks' iso-

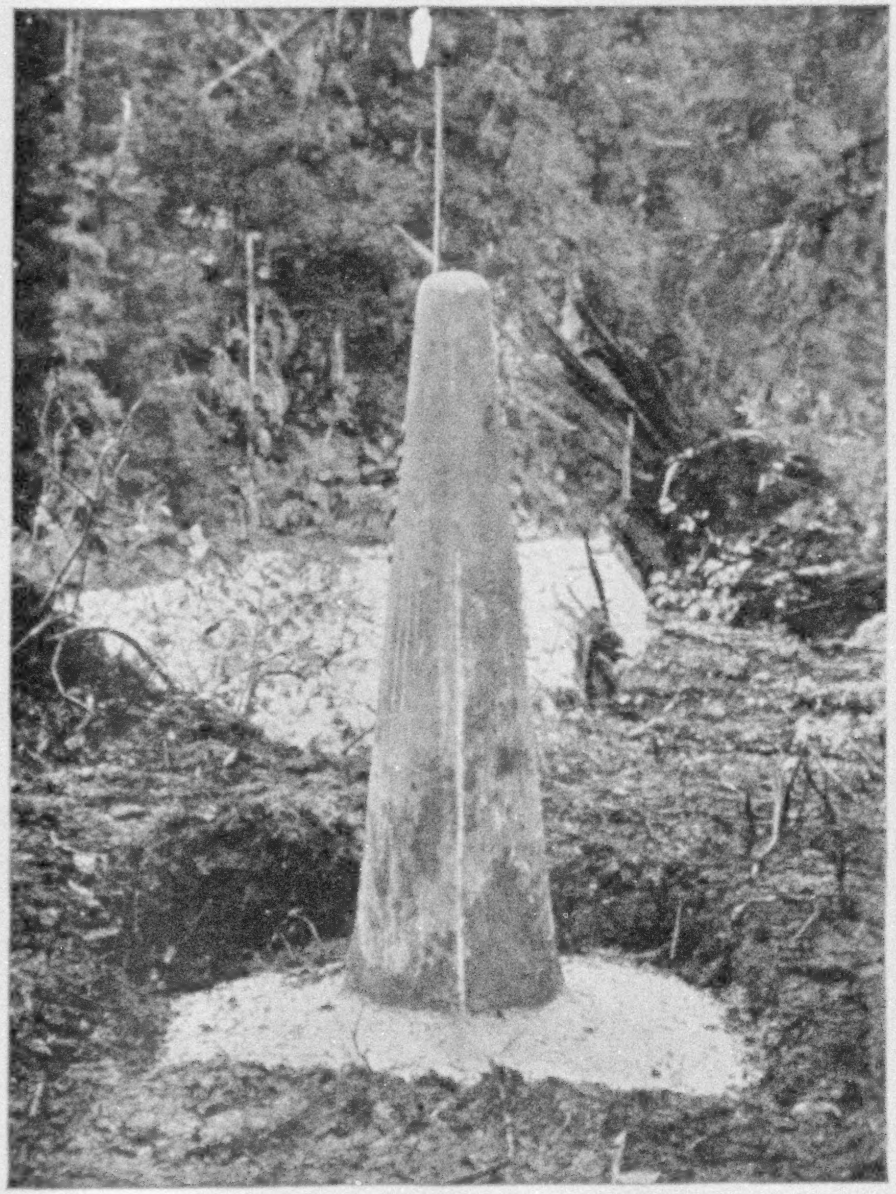


Photo by D. E. Eaton

TYPE OF ALUMINUM-BRONZE CONICAL MONUMENT USED FOR MARKING THE LESS IMPORTANT POINTS ALONG THE BOUNDARY

Photo by Thomas Riggs, Jr.

CAIRN SIGNAL ON THE DIVIDE BETWEEN THE TWO MAIN FORKS OF LADUE RIVER

Photo by Thomas Riggs, Jr.

A CACHE

Unless supplies are placed on an elevated platform of this description, bear and wolverine will soon destroy anything left along the trail

Photo by Thomas Riggs, Jr.

A WONDERFUL SET OF HORNS

Although we were out of fresh meat at the time, every one was glad that there was nothing more deadly than a camera around when this great caribou stuck his head over the skyline

XUM

Photo by D. A. McKinley

ON A TRIANGULATION STATION ALONG THE 141ST MERIDIAN

While working around a theodolite it is almost impossible to wear hat and veil, so a bandana handkerchief is usually tied around the head as a slight protection against mosquitoes.

Photo by Thomas Riggs, Jr.

WHITE RIVER WEST BASE

To see over a hillock or a clump of trees it is sometimes necessary to build a triangulation station of this description. The instrument is placed on the center tripod, which is separate from the observing platform surrounding it. The observer can then walk around his instrument without jarring it.

Photo by M. W. Pope

In summer the Indians utilize their dogs for packing. This particular pack weighs about 30 pounds. The dogs are always loaded with all they can stagger under

Photo by A. I. Oliver

Mosquitoes are so thick that unless some protection is given the horses cannot graze. The style of net for man is shown. The ends of the bib to which the net is fastened in the back and front are tied under the arms.

XUM

Photo by Thomas Riggs, Jr.

TOPOGRAPHER AT WORK ON THE ARCTIC CIRCLE

On June 22 the boys wanted to work all night. This is a snapshot at midnight

Photo by W. B. Reaburn

THE ARCTIC RANGE, OR BRITISH MOUNTAINS

This range runs very close to the coast at the boundary, the foothills coming to within only a mile or two of the ocean. The higher summits are about 7,000 feet high, and are perfectly bare of snow in summer. Timber ceases at this range, and the survey parties have to burn oil from here to the coast, where driftwood from the Mackenzie River can be picked up. A peculiar feature of this range is the large amount of coral and other sea fossils to be found.

Photo by Mrs. Herbert Wadsworth

INDIAN WOMEN AT RAMPART HOUSE WATCHING THE APPROACH OF THE STEAMER "VIDETTE" (SEE PAGE 690)

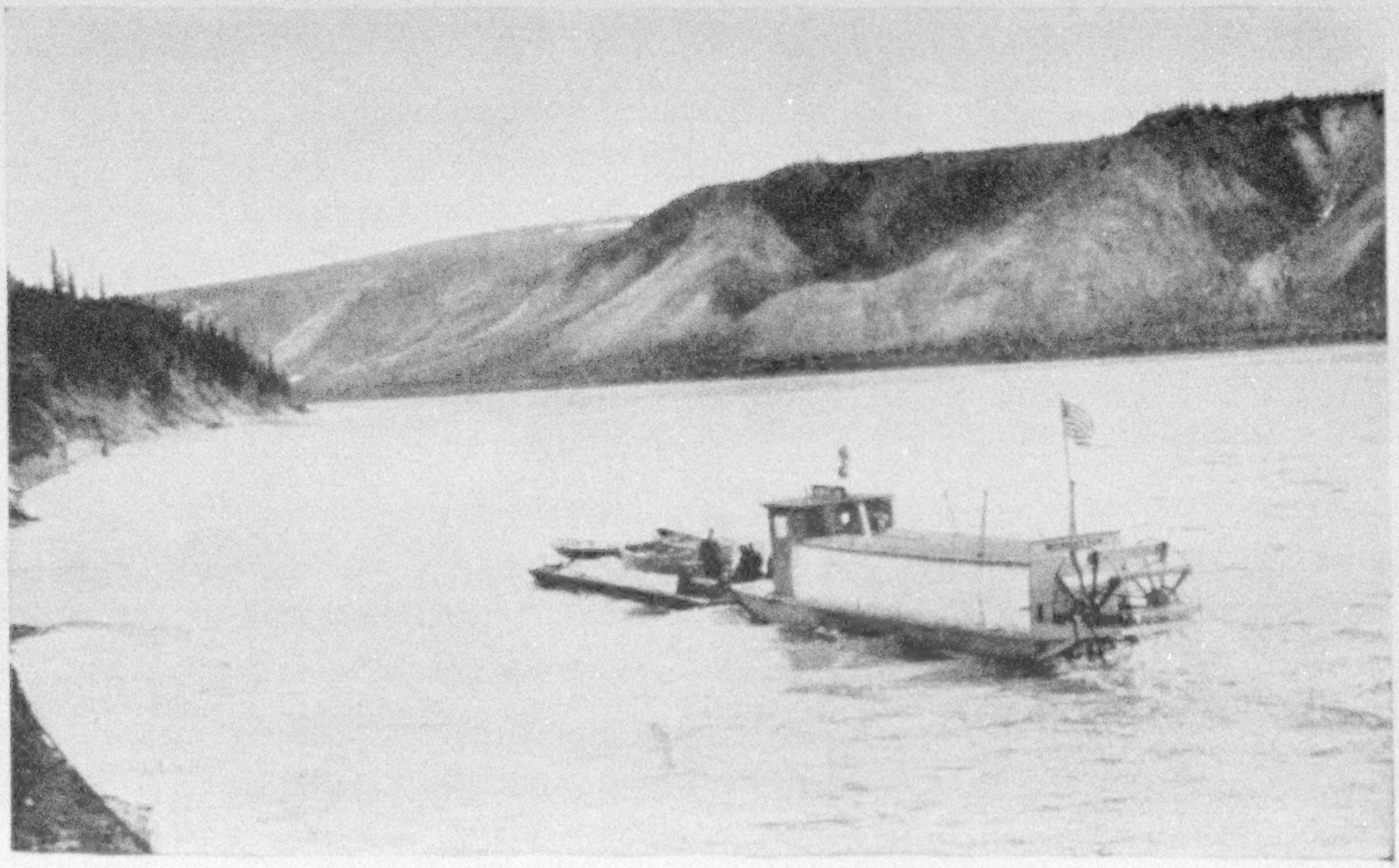


Photo by Thomas Riggs, Jr.

THE SURVEY LAUNCH "MIDNIGHT SUN"

Length, 50 feet; beam, 8 feet; draft, 18 inches; 25 horse-power gas engines. Pushing a barge, this little craft can transport from 10 to 15 tons. She did great service during the summer freighting on the Porcupine and Old Crow rivers and later in bringing the lumber for the hospital to quarantine (see page 710).

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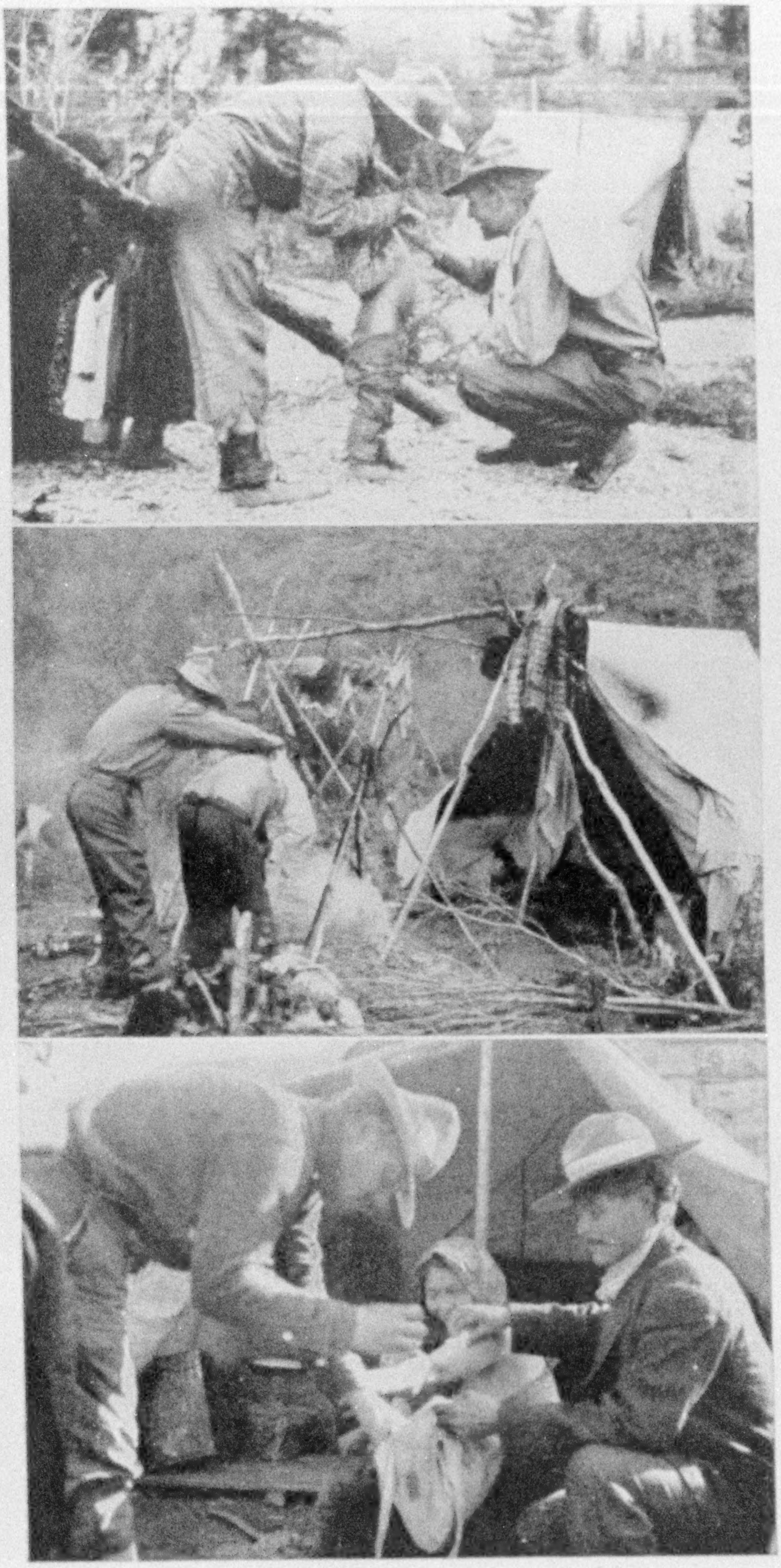


Photos by M. W. Pope

DAILY INSPECTION FOR SMALLPOX: VACCINATING INDIANS (SEE PAGES 699, 700, AND 703)

The adult Indians submitted to the inspection without any complaint, but the little ones had to be bribed with candy, a sackful of which was taken out every day. Soon they hailed the inspection as a great event.

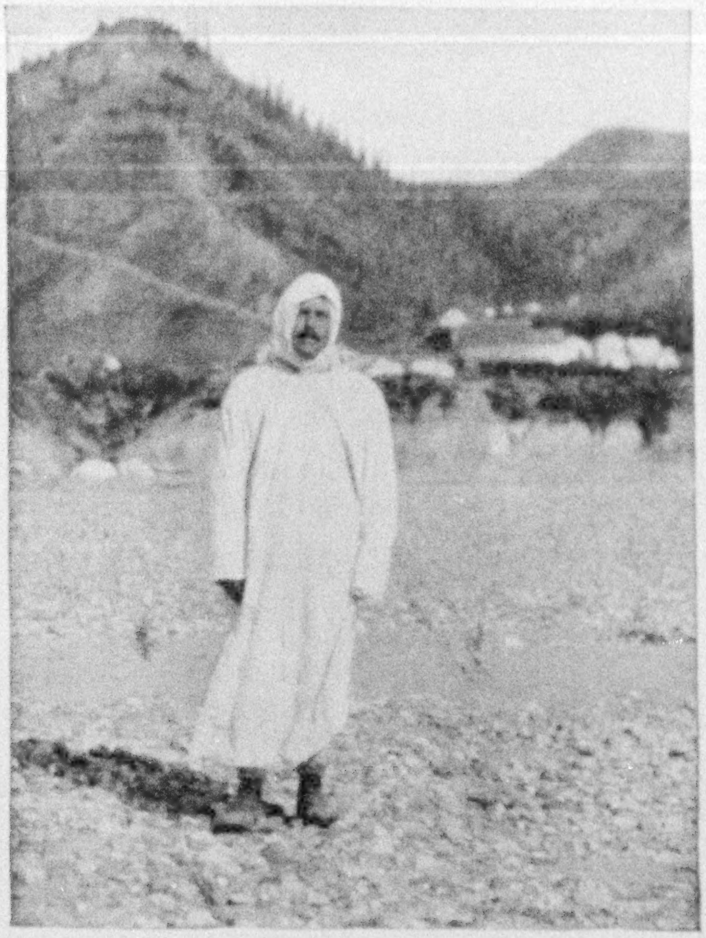
lation, came my turn. Reaburn, one of our surveyors, commonly known as the "Old Sleuth," and five others of the party volunteered to stay in during the winter for the purpose of storing and forwarding supplies for the next season and for looking after the Indians.

In response to a telegram, the Canadian authorities at Dawson had sent lumber for a hospital and carpenters, but, owing to low water, the steamer *Delta* was unable to bring it nearer than 60 miles of the camp. At this point the *Delta* dumped it on the beach and took on the parties and their outfits. The lumber was brought up by the *Frontiersman* and the *Midnight Sun*.

Late in September, when it had become dangerous to stay longer, Pope and I left Rampart House on the *Frontiersman*. At the "Aurora's Goat" rapids we met the little *Midnight Sun* with the last of the lumber, struggling bravely against the current. The thousand feet of lining wire was covered with a glaze of ice, one drive-chain was lost, two wheel-buckets were broken and patched, her house and wheel casings were encrusted with ice, but the undaunted crew drove her to quarantine (page 709).

The erection of the hospital undoubtedly saved the lives of many of the 92 afflicted Indians.

At the time of my leaving there had been but one death. Amos Njootli, an ordained priest of the Church of England, although himself smitten with smallpox, read the

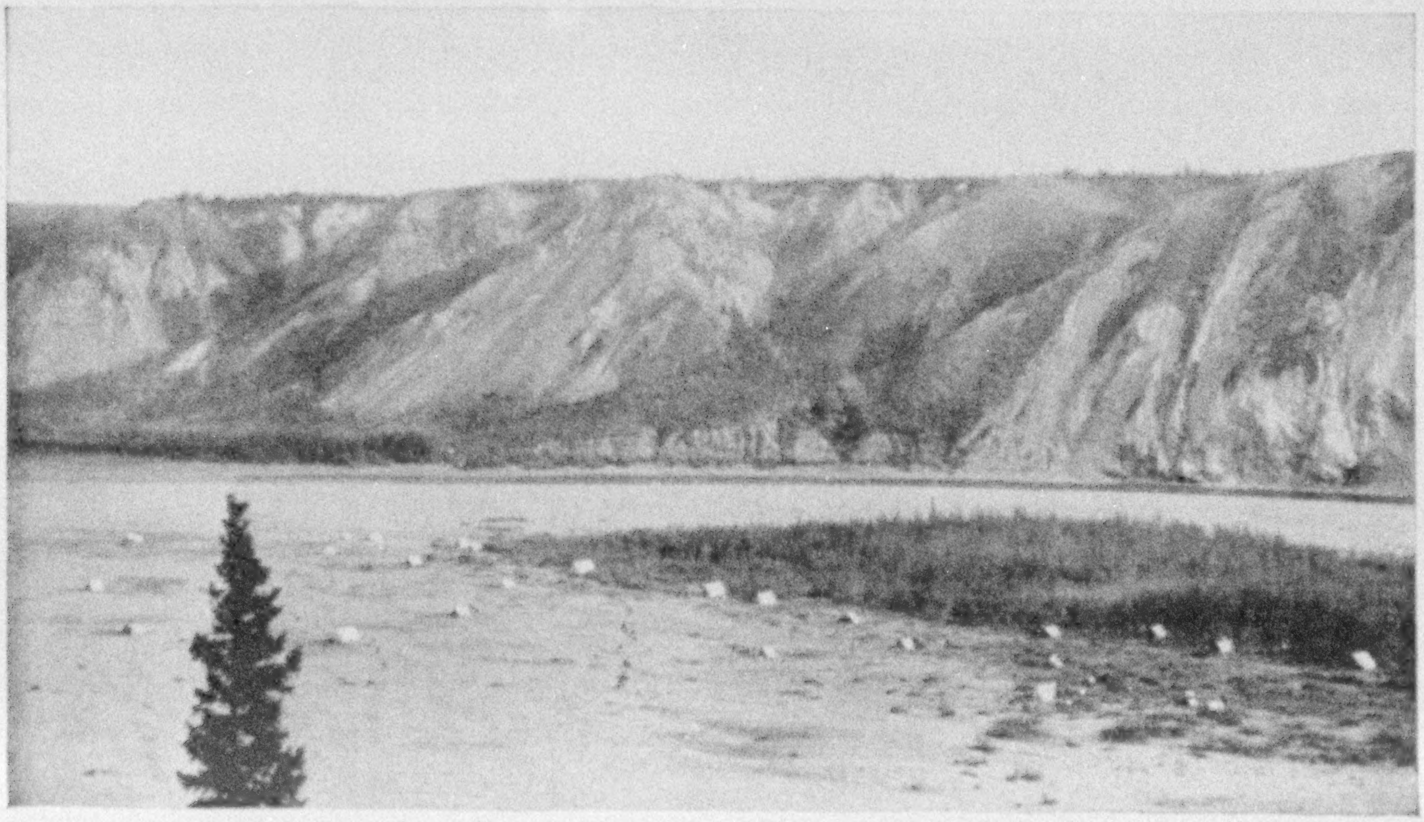


DR. SMITH ON THE WAY TO VISIT SMALLPOX PATIENTS

When in contact with smallpox patients the doctor always wore a cotton shirt covering his clothing, which was thoroughly disinfected after each visit.

FUMIGATING

After being among the smallpox Indians, all hands would be fumigated. This was done by getting in an air-tight tent, all except the head. About eight ounces of formaldehyde were then evaporated inside the tent. After about 10 minutes the germs were all considered dead.



Photos by Thomas Riggs, Jr.

SMALLPOX CAMP ON EDMONDS ISLAND

With the exception of the nurses' tents, which are shown in the center of the picture, every tent shown contained one or more cases of smallpox when the photograph was taken

Photo by M. W. Pope

ONE AND A HALF CORDS OF FUR AT RAMPART HOUSE AWAITING SHIPMENT

The precious furs of fox and sable have been sent to London. The furs seen here are mostly muskrat, about 17,000 of them

Photo by F. Lambart

THE HOME OF THE SQUAW MAN

Seemingly perfectly contented, the squaw man is found in most unexpected places. They are usually kind to their wives and devoted to their children. They eke out an existence by trapping, mining, or guiding hunting parties.

XUM

burial service in the Indian language. The body was laid away in a grave on the bluff overlooking the river, while the whole population of the island joined in the singing of a weird interpretation of "Nearer, My God, to Thee."

The Indians of this country are nominally all Christians, and are visited every year by Bishop Stringer, of the diocese of the Yukon. Many are communicants of the Church of England. They are also communicants of any other church with which they may have come in contact. They also hold fast to many of their old customs, and in consequence we shall probably have to pay for the one person who died, or take the chance of a shot from ambush.

With it all there is an unexplainable fascination about the North. The very hardships lend a paradoxical charm. The vast solitudes, uninhabited and lonely, have an irresistible call. The surveyor dreads the day when he shall have thrown his last diamond hitch, broken his last camp, and, from the deck of a homeward-bound steamer, have watched a free life fade away in the mist with the distant hills.

WHERE OUR BANANAS COME FROM

By Edwin R. Fraser

THERE exists a legend relative to the Christian inhabitants of the East, that they believed the banana to be the tree of the source of good and evil, in a bunch of whose fruit the serpent that tempted Eve hid itself, and they add that when Adam and Eve became ashamed of their nakedness they covered themselves with the leaves of this plant. Beyond all doubt this legend had some influence upon the minds of those early botanical classifiers who designated two species of the plant by the names of *Musa paridisiaca* and *Musa sapientium*—Fruit of Paradise, Fruit of Knowledge.

The origin of the banana is given as India, at the foot of the Himalayas, where it has been cultivated since remotest antiquity. Its origin in the New World is as doubtful as the origin of the American Indian. Natural to Asia and Africa, where more than 20 distinct species of the genus are known, it is said to have been brought first to America from Spain, early in the sixteenth century, and planted in the island of San Domingo, whence its spread was rapid throughout the surrounding islands and the mainland. This has never been authentically established, however, and some authorities include the banana among the articles that formed the base of the food supply of the Incas and the Aztecs before the arrival of the Spaniards. Certain it is that throughout the whole of meridional America there is a strong tradition that at least two species of the plantain were cultivated long before the coming of the Europeans. Furthermore, it is singular that in all the languages indigenous to the region where the banana appears, that plant has a special name, not proceeding from the conquerors, as was the case with the names of many other plants, animals, and various articles introduced into America after its discovery.

Grown over the entire extent of the meridian of the earth, the fruit of the banana today forms, in large part, the principal food of a majority of the peoples living under the tropical zone. Several species and numerous varieties of the plant appear throughout tropical America, but it is cultivated for commercial purposes in appreciable quantities only along the Atlantic border, from southern Mexico to Colombia, in Jamaica, Cuba, San Domingo, and the Bahamas, the far western markets of the United States being supplied from the Hawaiian Islands and Mexico's south Pacific coast.

The lowlands adjacent to Costa Rica's eastern coast present a combination of soil and climate that is perfectly adapted to the cultivation of this plant. It thrives best under conditions of extreme heat

Photo by Edwin R. Fraser

THE CHINESE DWARF GUINEO, OFTEN PLANTED IN THE GARDENS AND PLAZAS OF THE TOWNS AS AN ORNAMENT

The negroes use the leaf as an umbrella. The ribs of the leaves are woven into cloth by the Filipinos

Photo by Edwin R. Fraser

A BUNCH OF PLANTAINS

The stem grows out of the top of the plant and shoots over to the side

XUM

Photo by Edwin R. Fraser

A TYPICAL BANANA FOREST IN COSTA RICA

Note the long stem and flower tipping the bunch of bananas in the left center of the picture; also of the bunch in the upper left corner

and humidity, a temperature below 75 degrees Fahrenheit or an elevation more than 1,500 feet above sea-level retarding its development.

The frequent showers, interspersed with hot sunshine, peculiar to eastern shores in the tropics, give the plant its ideal environment, and it may be counted a certainty that where climatic conditions favor the banana it is extremely unhealthful for the white man. Of prime importance, also, is a rich soil, clayey and sandy soils rich in humus and alluvial deposits being required.

Given the requisite soil and climate, the banana requires little attention, producing fruit every month in the year, and is self-propagating by means of suckers, which continually shoot off from the mat at the root of the mother plant. Under cultivation these suckers are kept down, as the welfare of the mother plant demands, from three to five to each mat being allowed to remain, coming on from three to five months behind the parent, and so on in perpetual succession. Sometimes more than a dozen suckers, in groups of different ages, may be seen in a single mat.

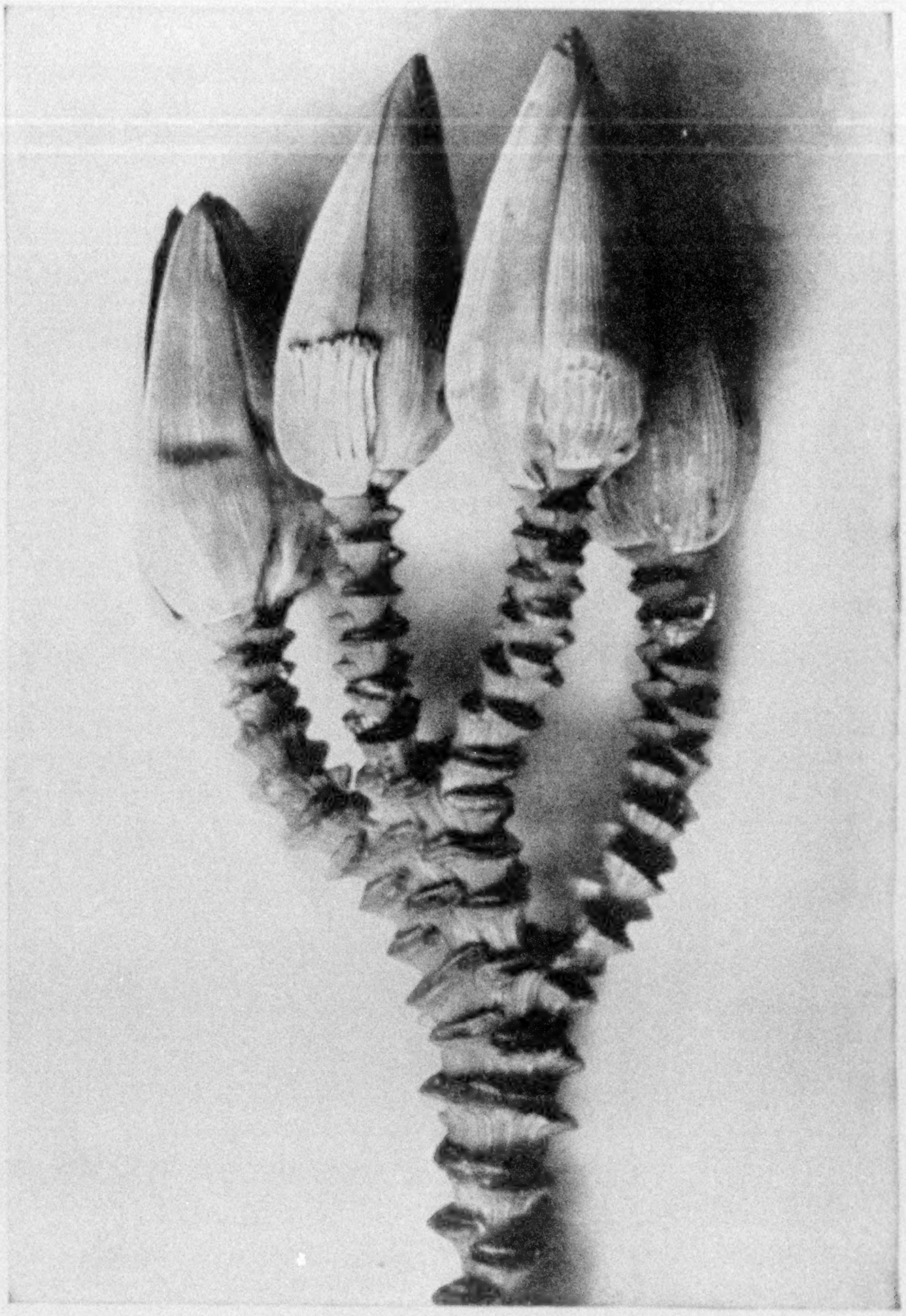


Photo by Edwin R. Fraser

THE FLOWER OF THE BANANA GROWS AT THE TIP OF THE STEM, BEYOND THE FRUIT

The occurrence of four flowers on a stem is extraordinary, one being the rule

At the age of 10 to 11 months the fruit is gathered, and consists of one bunch or stem to each plant, the fruit being arranged around a fibrous stem in layers, called hands, with 7 to 12 hands, or 15 to 25 fingers to the stem, the total averaging 12 dozen bananas. This stem grows out of the top of the plant, being, in fact, a continuation of it, and, by the great weight which it bears, shoots over to the side, with its upper end extending downward (see pictures, pages 716, 717). The stem is elongated from two to three feet beyond the fruit and is tipped by a formation of matted purple leaves, in the shape of a spear point, which is called the flower.

The plant, now shortly dying naturally, under cultivation is cut down, to give place to its three to five successors, that being the number usually grown in each mat. For planting new areas the young suckers are cut off close to the mat and transplanted in holes 20 inches deep and 15 feet apart each way.

Several distinct species, known as the plantains, the *Musa paridisiaca* being the most common, occur in numerous

variety throughout the American tropics. One of these, the "Five Hundred," is noted for the enormous size of its stem, frequently reaching more than 12 hands, with over 200 fingers, and when the fruit is small there are sometimes from 300 to 500 on a single stem. A San Domingan variety, on the other hand, produces bunches of only 10 to 25 fingers, each plantain a foot long and weighing from two to four pounds.

In general the fruit of the plantains is more fibrous in texture and larger than that of the *Musa sapientium*, which is the species most widely cultivated for export, and nearly all varieties of which are commonly referred to as the banana. Most of the former are cooked green, few of them being edible raw, while the latter, because of its superior flavor and the high percentage of sugar which it carries, is in high favor as a table fruit.

The species *Musa sapientium*, of Indian origin, is represented in America by many varieties, each differing from the other slightly in size, shape, color, and flavor of fruit, and the number to a stem. It has greater resistance than other species, produces bunches more compact and regular, of a uniform weight and size, that stand transporting better, and the fruit is well formed and succulent.

In Costa Rica the species ordinarily attains a height of 25 feet from the ground to apex, although it frequently reaches 30 feet, and has been known to increase in height three feet in a single month. The Congo variety grows to 18 feet, while the dwarf guineo, indigenous to China, reaches but six to nine feet, with very small fruit. The latter is much admired for the beauty of its leaf and is frequently found in the patios of the homes and the public plazas of the towns, where its influence is commanding, exerting a truly tropical charm.

The total area to bananas in the several districts adjacent to Costa Rica's Atlantic seaboard is approximately 80,000 acres, one-third of which is owned and cultivated by the United Fruit Company. Altogether there are some 200 small outside growers of the fruit, for the most part Americans and Europeans, a few of whom have holdings reaching several thousand acres each. The line of railway connecting the banana belt with tidewater being controlled by the United Fruit Company, all outside fruit grown in the country is sold to that company, nine-tenths of it being grown under contract for the company to purchase at a price agreed upon in advance, which ranges from 15 to 30 cents gold per bunch, according to grade. The company also owns a large fleet of specially constructed ships, which carry the fruit to overseas ma kets.

Costa Rica at present exports annually, in round numbers, 10 million bunches of bananas, and this quantity is exceeded only by that of Jamaica, which is approximately 12 million. It is probable the latter figures will soon be equalled in Costa Rica, when the large areas of new ground now being brought under cultivation become productive. During the busiest season an average of a steamer a day leaves Port Limón with fruit for the American and English markets, the exportation sometimes reaching a total of over a million bunches in a month.

Of the country's exports, approximately four-fifths go to the United States and one-fifth to England. Of the fruit sent to the United States, nearly one-half enters through New Orleans, which is the most important banana port in the world, with a total importation of a little less than 14 million bunches during the fiscal year ended June 30, 1911, one-fourth of which came from Costa Rica. The remainder of the product is taken by Boston, Mobile, and New York, in the order named.

The fruit is cut green, at different stages of development, depending upon the market for which it is intended. That destined for New York and Boston, a large part of which is consumed at those ports without an additional haul by rail, is cut at a more advanced stage of development than fruit going to more distant ports, or which is to be reshipped to the interior by rail. Thus a large proportion of the fruit entering at New Orleans and Mobile is cut at an earlier stage of development than that sent to New York; the fruit for the English markets is cut still less mature. The first is called "full" fruit, the second "three-quarters full," and the last "three-quarters."

Photo by Edwin R. Fraser

CUTTING BANANAS

Note the great height of the trees. They sometimes reach 30 feet. Also note the huge size of the leaves

Photo by Edwin R. Fraser

CUTTING BANANAS

The top of the tree is pulled down with the pole and the stem cut with the *machete*. Note the flower at the end of the bunch of bananas

Photo by Edwin R. Fraser

CUTTING BANANAS

The tree bears but once, after which it is cut down and is succeeded by the young suckers growing out from its roots

Photo by Edwin R. Fraser

FIRST-GRADE FRUIT

Each bunch has from 120 to 180 bananas, the average being 144. Every farm is provided with its own tramway leading to the railroad. All the work on the banana plantations of Costa Rica is done by Jamaican negroes

Photo by Edwin R. Fraser

FRUIT AT RAILWAY AWAITING TRANSPORTATION TO THE WHARF AT PORT LIMÓN

Photo by Edwin R. Fraser

BANANAS COVERED WITH THE LEAVES OF THE PLANT FOR PROTECTION FROM THE SUN

Photo by Edwin R. Fraser

LOADING BANANAS ABOARD A FRUIT TRAIN IN COSTA RICA

Photo by Edwin R. Fraser

BANANAS AWAITING TRANSPORTATION BY RAFT DOWN STREAM TO RAILWAY

XUM

Photo by Edwin R. Fraser

TRANSFERRING BANANAS FROM CAR TO SHIP AT PORT LIMÓN, COSTA RICA

The fruit must be handled with great care to prevent bruising. The Jamaican negro is experienced in all branches of the industry. The fruit is carried over canvas rollers and into the ship's hold; 2,000 bunches per hour are loaded or unloaded by this means

Photo by Edwin R. Fraser

A WASHOUT ON THE RAILWAY

Costa Rica is a land of torrential rains and riotous rivers

As all fruit is sold delivered at the railroad, each farm is provided with its own tramway leading from the fields to the railroad, the cars being drawn by mules. Notice is given to the grower to deliver a specified quantity of fruit alongside the cars on a given date, for shipment by a certain vessel, and within 12 to 18 hours after the fruit is cut it has been transported to Port Limón and loaded aboard ship ready for sea.

At the wharf the fruit is transferred from car to ship, at the rate of 2,000 bunches per hour, by mechanical loaders, specially designed to carry it without bruising, over canvas rollers and into the ship's hold. Upon arriving at its overseas destination the fruit is unloaded in the same manner, and within a few hours after the steamer has docked its cargo has been placed aboard special trains of refrigerator cars, waiting to carry it to interior points of distribution.

Thus the bunch of bananas hanging at the corner grocer's, in the small town of the middle West, or New England, has been, in most cases, less than 15 days out of its native habitat in the tropics.

The labor employed in all departments of the banana industry of Costa Rica, as in most banana-producing countries of America, is the Jamaican negro. He not only shows an almost total disregard of the dangerous climatic conditions, but he is experienced in the work, which he learned in his Jamaican home. Indeed, it may almost be said that the existence of the industry—on its present magnitudinous scale at least—is dependent upon the ability of the black man to work year after year in an environment that all too frequently is fatal to the white man and from which, to preserve his life and health, he is compelled to remove himself at frequent intervals.

The annual rainfall in the banana districts is enormous, but the Jamaican continues his labors alike through torrential downpour and the sweltering heat of a tropical sun, rarely falling a victim to the deadly fevers to which the white man so readily succumbs.

The United Fruit Company alone employs upwards of 5,000 negroes in its Costa Rican division. The various purposes for which they are used include clearing and preparing new lands for cultivation, replanting, plowing, pruning, draining, and cutting and loading fruit. The three districts of Zent, Santa Clara, and Banana River are divided into farms, each of which has its white overseer, or *mandador*. Oxen are largely used for plowing and other work in the banana fields, as they are for nearly all hauling in Costa Rica, both in town and country.

The banana plant grows easily and has few enemies. One, however, which of late is giving the growers some concern, is called the *taltuza*, a small, dark-brown rodent, with protruding teeth, closely resembling the American gopher. Like the gopher, it burrows its way under the ground and attacks the roots of the banana, causing the plant to wither and die. This little animal has now almost entirely abandoned its former home in the woods for the banana fields, and no means has as yet been found to exterminate it. The United Fruit Company has gone so far as to bring scientists from the United States and Europe in an endeavor to devise a means of ridding the districts of this pest. Experiments were made by inoculating a number of the animals with disease germs and turning them loose, but little result was noted. The growers offer the laborers one dollar gold per head for trapping them, and in this way their increase is checked to some extent.

Wind-storms are another menace to the plant, to which it falls an easy prey, owing to its large foliage and the weight of the fruit at its top. The danger from this source is minimized by planting the trees in rows diagonal to the direction from which the heavy winds usually blow. Excessive rainfall also is harmful, and considerable outlays have to be made for draining the surplus water from the roots of the plants. Rich as the soil is, it shows a tendency towards deterioration after a few years, necessitating a rest by plowing and letting the land lie idle a season. Commercial fertilizers are little used in the country, but experiments are being made by planting cow-peas where enrichment of the soil is needed.

XUM

The banana was long considered an inferior article of food, fit for consumption only by the yellow and black races of Asia and Africa, and it was not until Baron Humboldt, following his voyages to New Spain, called attention to the richness in alimentary sustenance of the fruit and the enormous quantities of it produced on small areas that its importance became generally known.

Of the many forms in which the plantain is served in the hotels and homes of Costa Rica, the baked and fried dishes are more agreeable to the taste. A well-flavored green plantain, sprinkled with sugar and baked in the oven until brown, when the syrup of the fruit issues forth, makes an appeal that is not easy to resist if you are fond of sweets. Sliced lengthwise and fried they are hardly less palatable, and in this style they are frequently served with beefsteak. The various soups of which they form the base may also be recommended, but the boiled plantain, which is a universal food among all classes wherever the fruit is found, does not meet with the same high favor with most foreigners. An excellent dessert, somewhat in the form of a preserve, is made by taking the baked plantain, as above, and cutting it into three or four pieces, adding more sugar and stewing.

A nutritious and easily digestible flour is obtained from the banana after it has been dried in the sun. This flour is said to act as a cure for indigestion and other stomach disorders, and is highly valued by the native women as an infant food. Equal parts of this flour and wheat flour are used in making a bread that is of pleasing taste and nutritious, but worthy of mention more for its digestibility. Artificial heat is also employed in drying the banana to make this flour, and in some countries, notably Jamaica, the industry is of growing importance.

Besides eating the fruit, the inhabitants of the countries where it is grown employ it in a wide variety of ways to supply many of the needs of life. From one species an acceptable quality of vinegar is made simply by mashing the fruit and placing the mash in an earthenware jar covered with a linen rag, allowing it to ferment. The ripe plantain, fermented, gives on distillation an extremely strong brandy, not very agreeable to the taste, and the natives, although accustomed to strong liquors, usually give preference to milder beverages. With the essence extracted from the guineo plantain, a short, thick variety, an aroma, or bouquet, is given to false cognacs and brandies in Europe which are destined for exportation. For coughs and bronchial inflammation a pectoral is made by roasting an unpeeled banana in the oven, removing the skin, then thoroughly cooking it in a little water, taking the syrup. From the ribs of the leaf, which differ in color according to species, the Filipinos weave a remarkably fine cloth, but the most useful service which the leaf renders to the negroes of the banana fields of Costa Rica thus far is protection from the heavy rains, and for this purpose it is better than the finest silk umbrella.

Remarkable as the development of the banana industry has been since the first bunches were shipped, only three or four decades ago, it may be said to hold fully as great promise for the future. The markets where the fruit is already known are insatiable, and practically unopened fields for it are found in the countries of continental Europe. In England its consumption is increasing at a phenomenal pace, as the sterling qualities of the fruit become known and the price cheapened. Where but a few years ago the fruit was obtainable only in the larger cities of that country and each banana was wrapped in tissue paper, commanding a price that only the few could afford to pay, today there is hardly a green-grocer at a country cross-roads who does not sell it.

In July, 1910, the Costa Rican government placed an export duty of one cent gold on every bunch of fruit leaving the country, effective until July, 1930, which is the first direct revenue it has derived from the country's most important industry. This law is universally regarded as just; in fact, its effect has been to stimulate the growing of the fruit, since it gives assurance that the duty will be no higher during that period.

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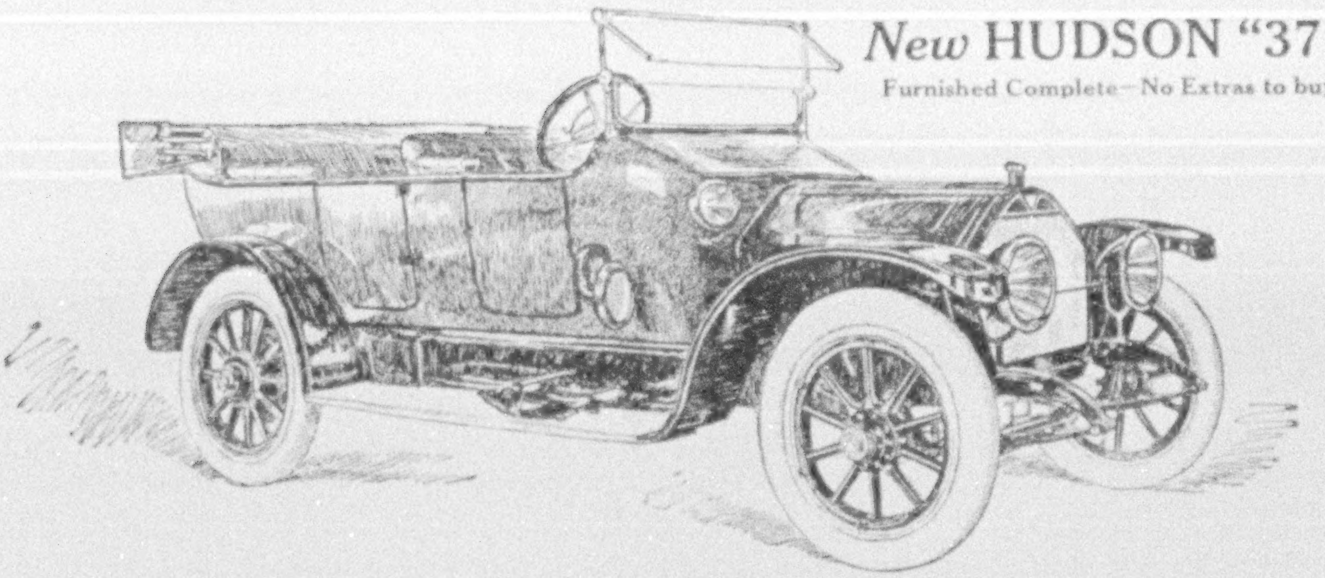

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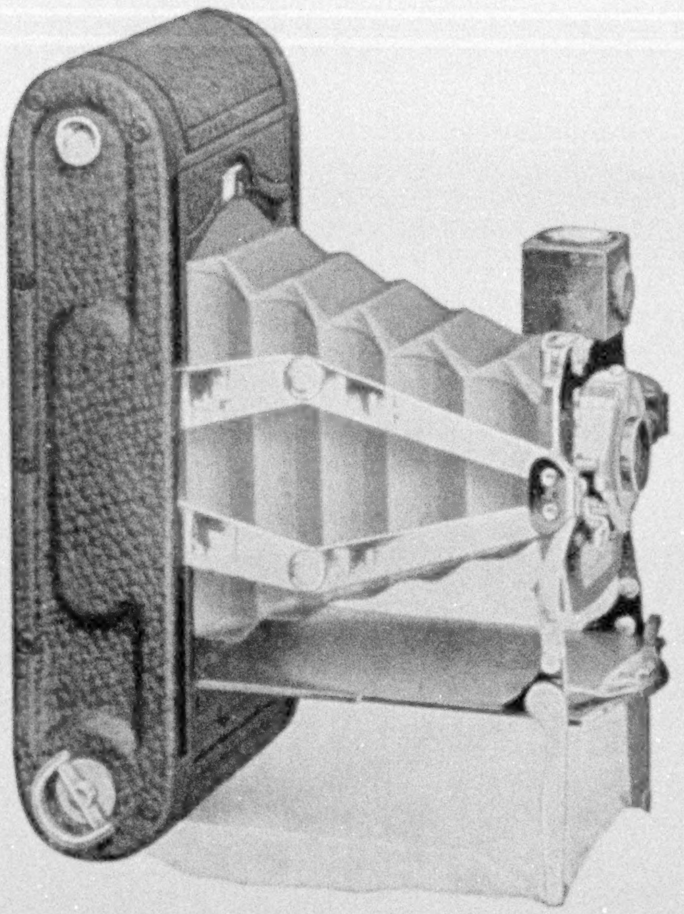

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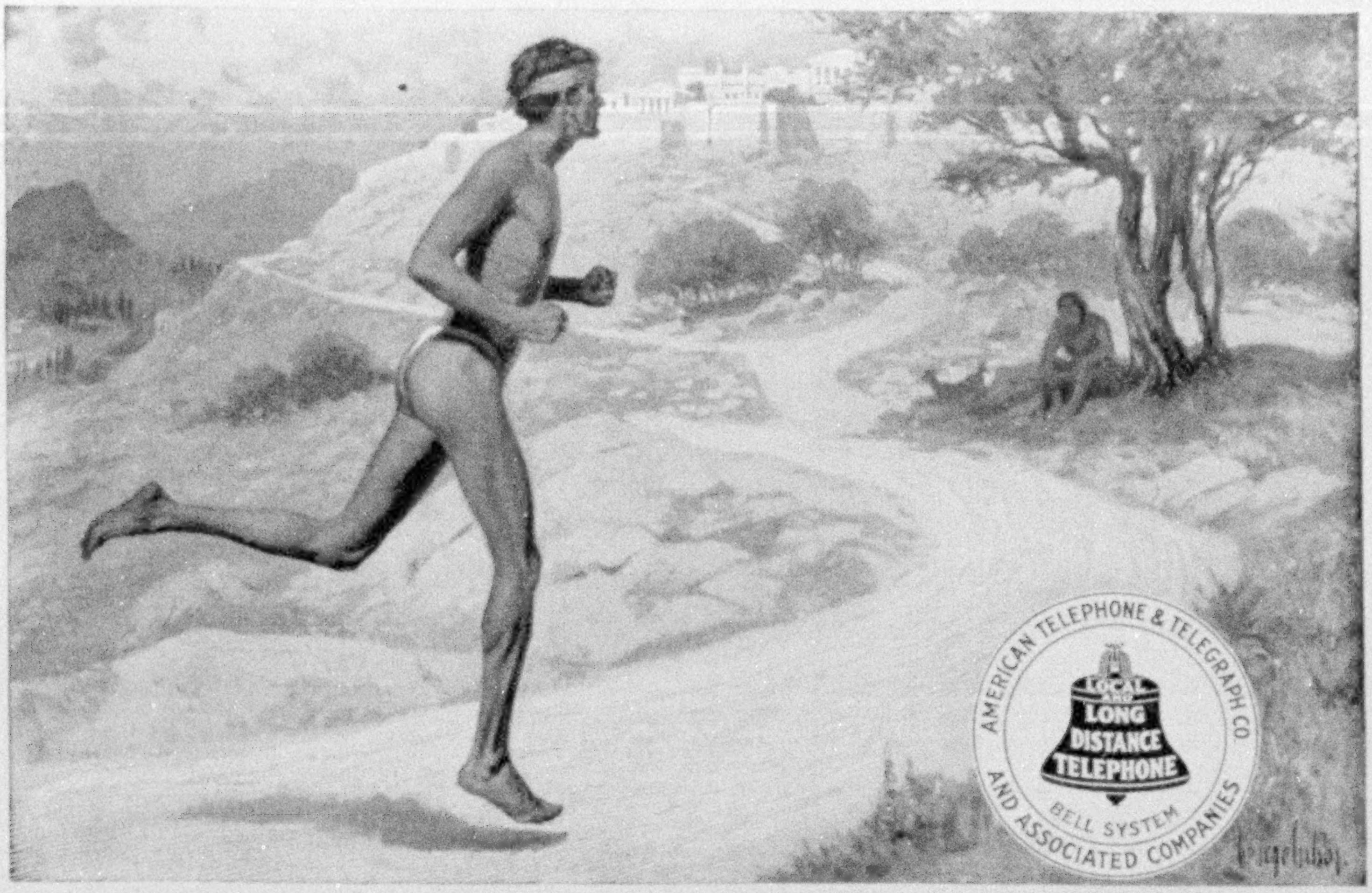

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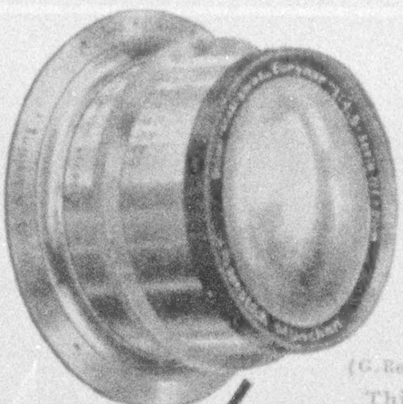

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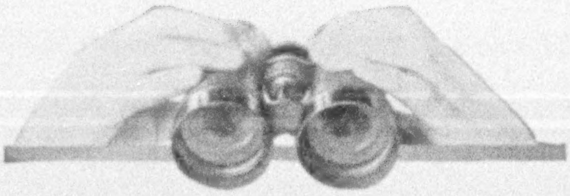

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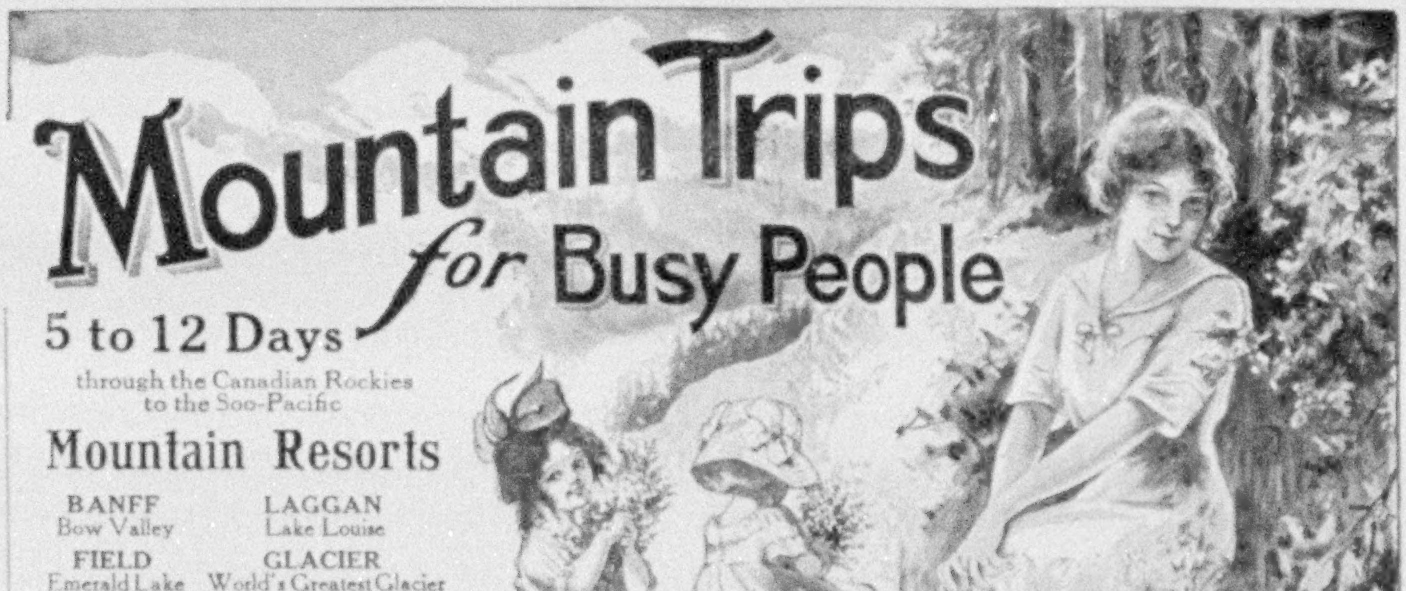

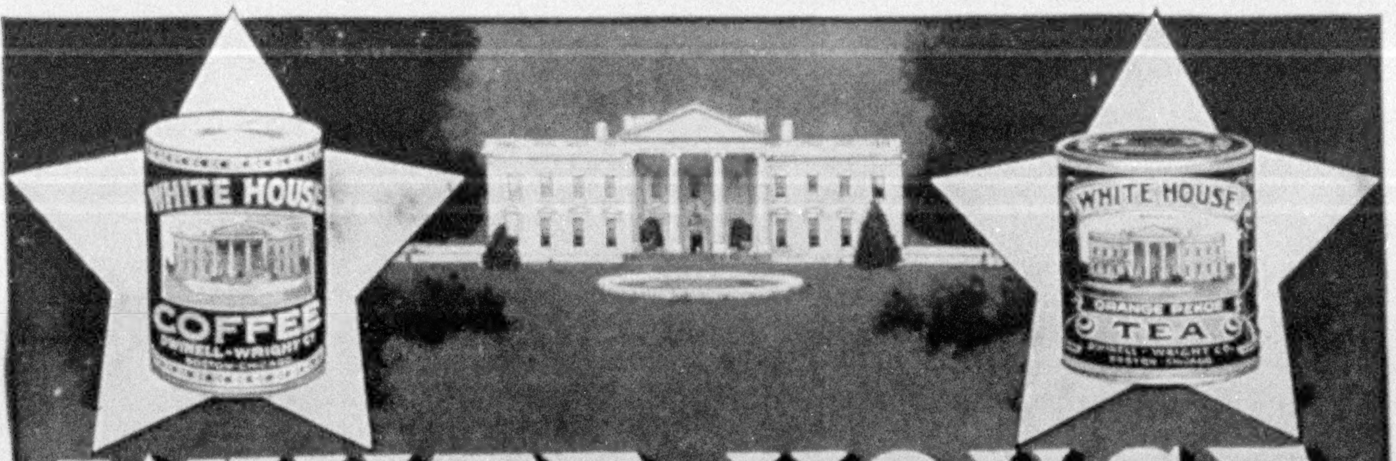

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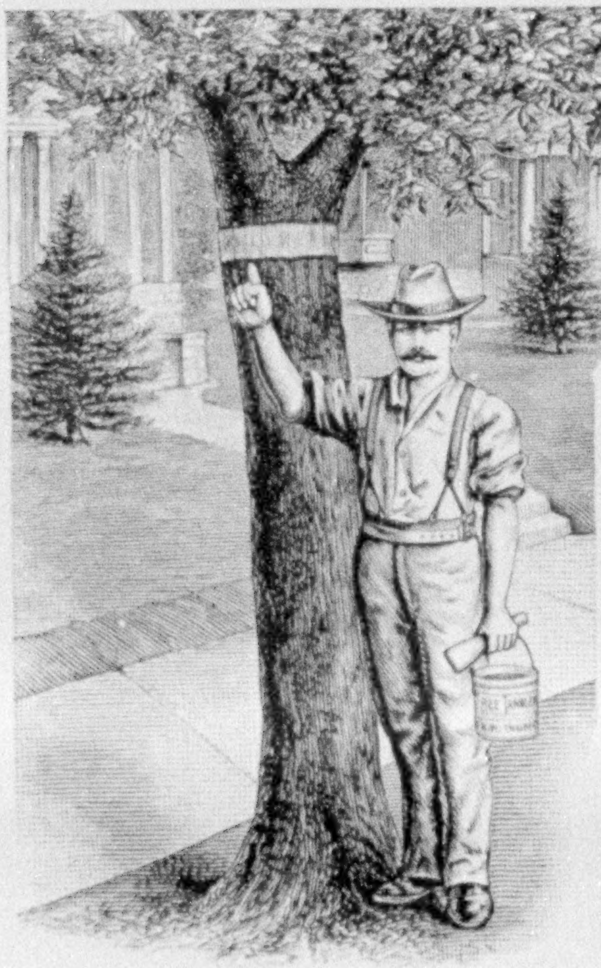

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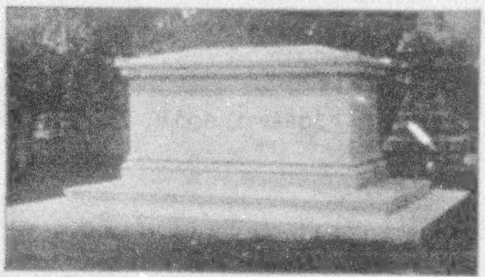

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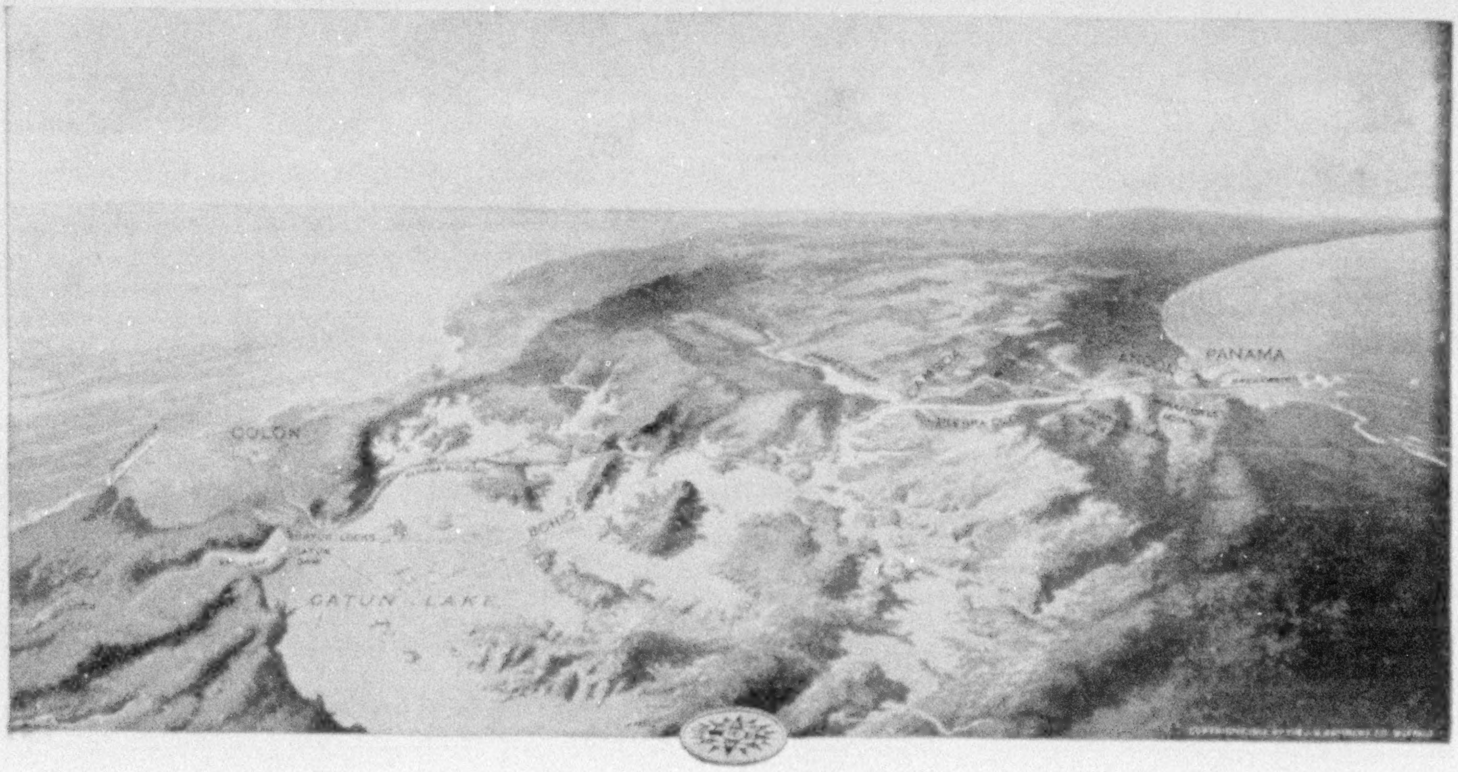

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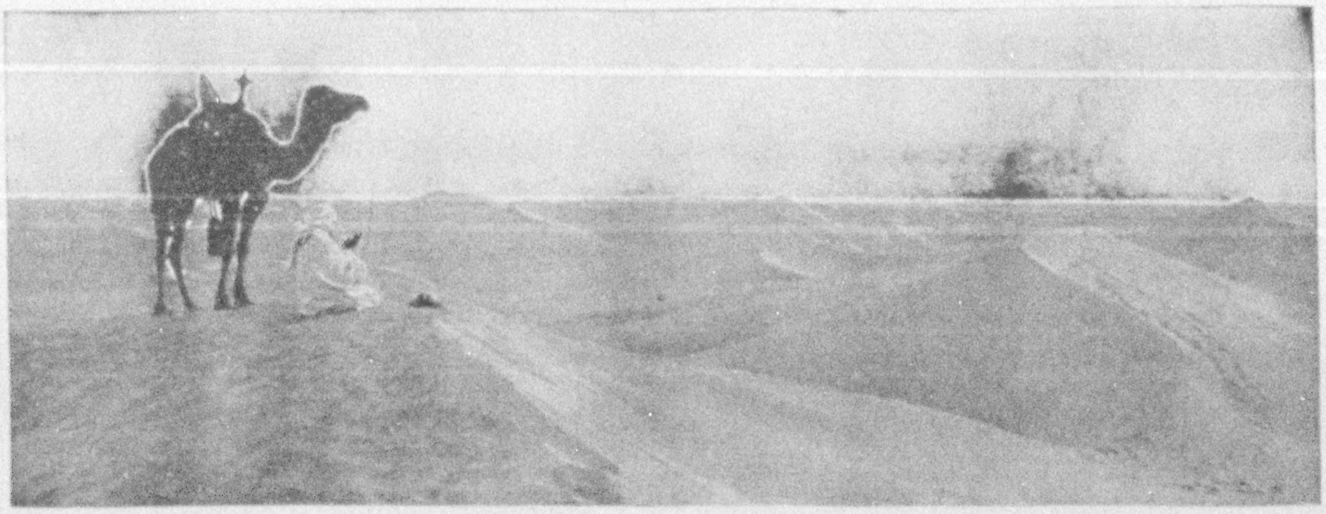

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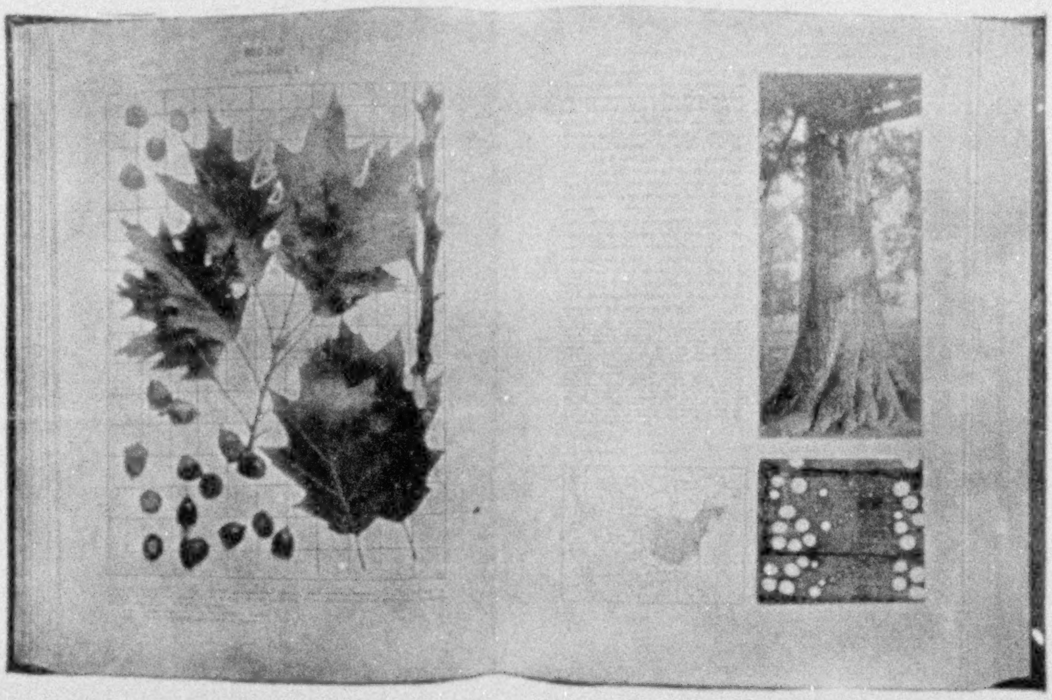

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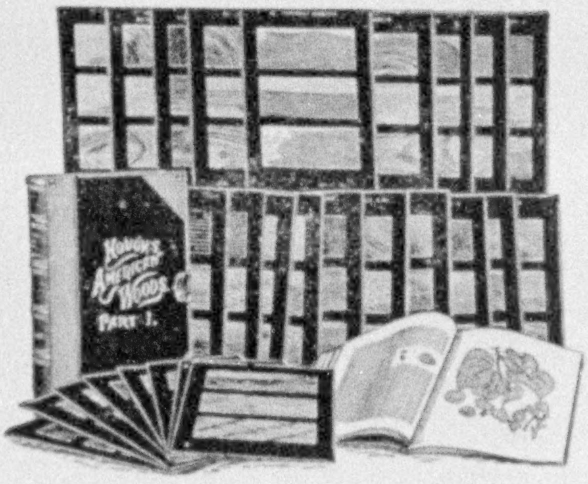

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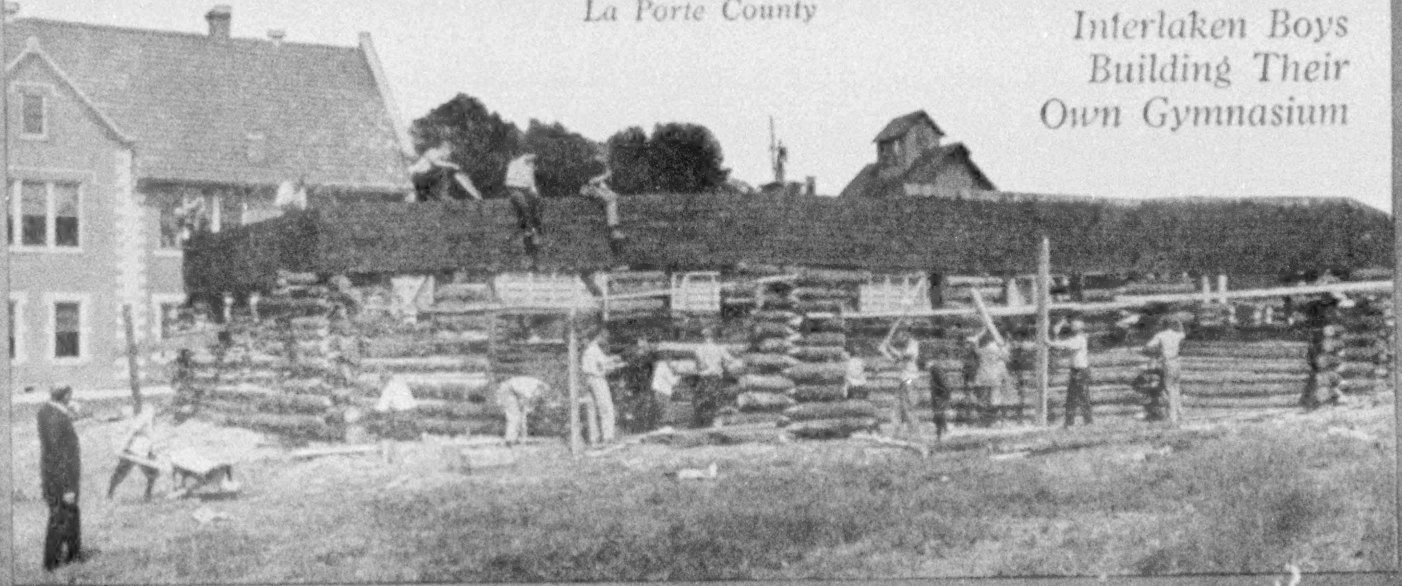

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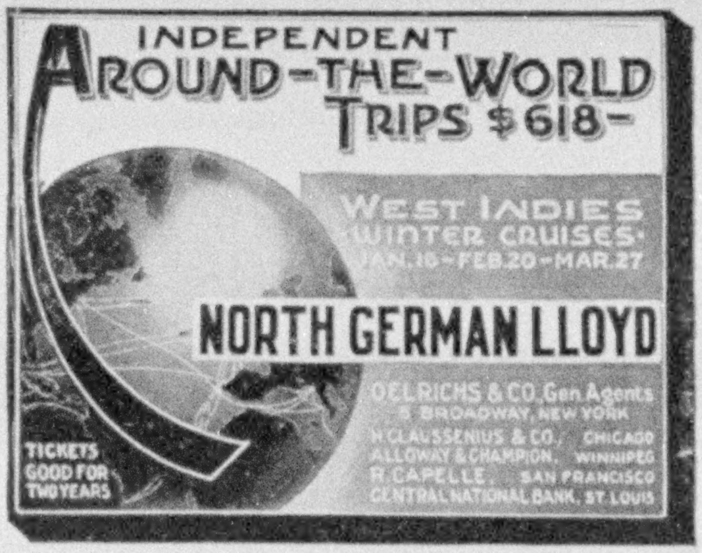

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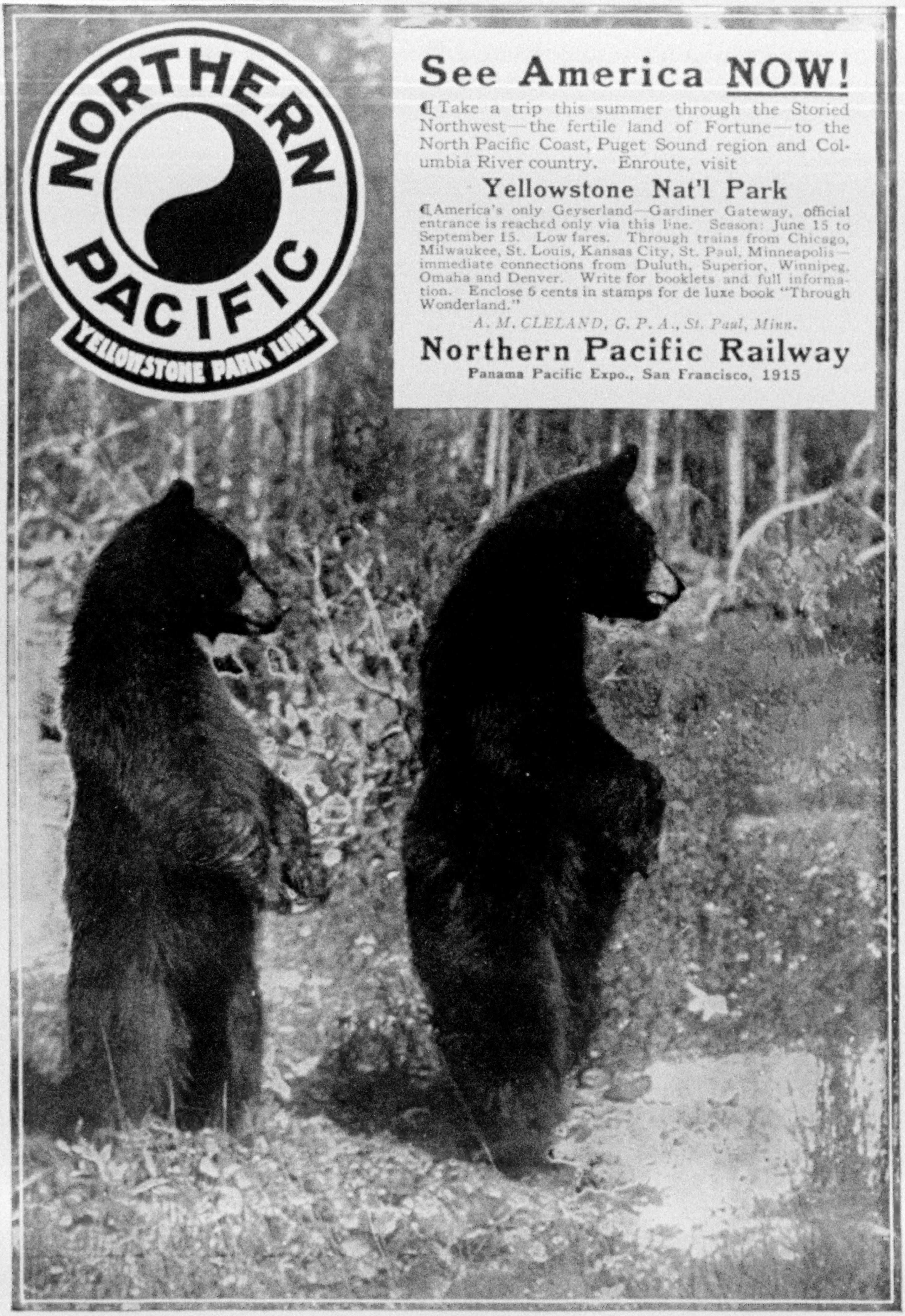
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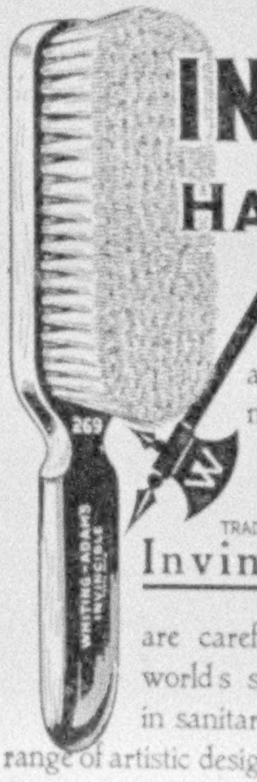

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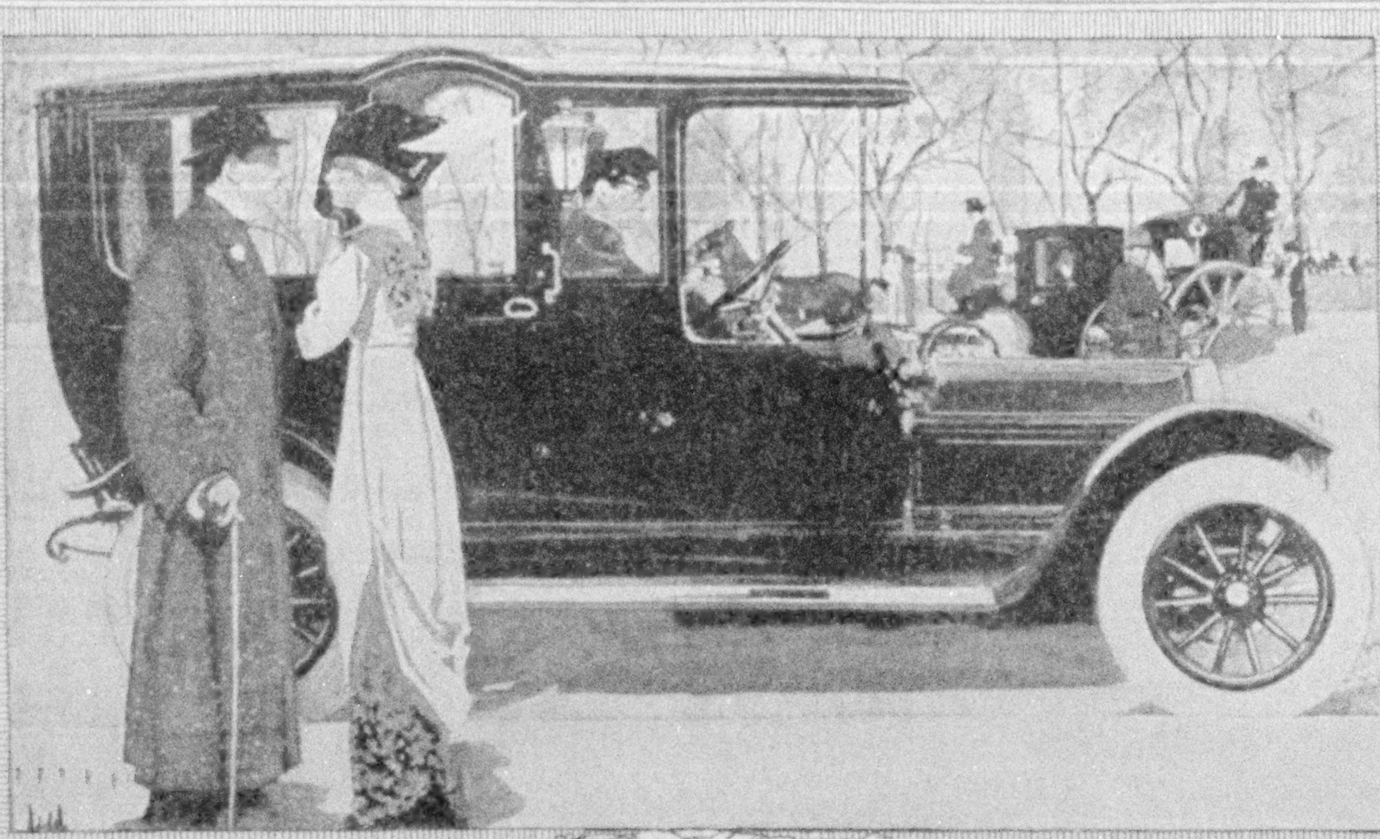

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